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Stamping and Assembling 100 Bodies an Hour

Fig. 1—General view of the press room showing also bundles of sheet steel stacked as unloaded from cars in the right foreground

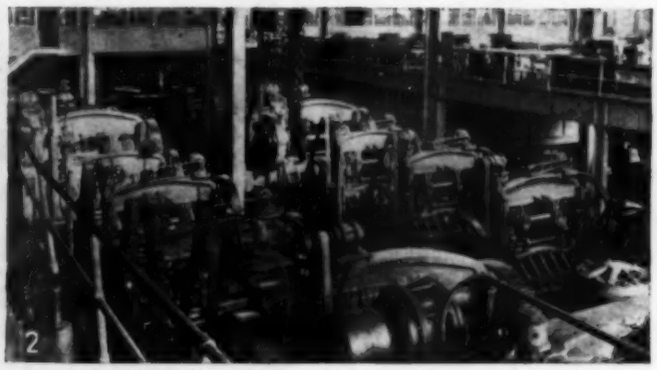


Fig. 2—One of the press bays. Dies are stored in the balconies at each side. Sheets are fed successively through each press in the row

By C. W. Avery

President, The Murray Corporation of America

This new Murray Corporation unit is laid out especially for economical handling and rapid production

IT RECENTLY became necessary to increase our manufacturing capacity by approximately 900 finished bodies per day, bringing our total daily capacity to about 2,500 bodies. To accomplish this, we built and equipped, at a cost of $5,750,000, the new unit, which will be described in detail in this article and another to be published in a later issue. This new unit was designed to function as a complete plant within itself, with just one thought in mind: namely, produce one hundred quality automobile bodies per hour in the most efficient manner possible. To attain this end it was necessary to use the most advanced equipment available and in many instances to have machinery designed and built to our requirements.

The press shop, measuring 400x360 ft. and having a clear height of 30 ft., produces the stampings for these bodies. Adjoining it on two sides is a seven-story L-shaped building in which the stampings and other parts are processed, assembled and finished. In this unit we employ mostly straight-line methods for material handling and production with marked economy.

In the press shop, where all material is received and unloaded from the two tracks of a freight siding, there are three 75-ft. and one 25-ft. bays each 400 ft. long. Bundles of sheet steel are unloaded from the cars to the adjacent section shown in Fig. 1, by overhead cranes. Much of the stock is received cut to size, ready for passing through presses as rapidly as needed. The presses themselves are arranged in adjacent bays in such a way that the sheets pass through them in successive steps, finally issuing at the far end where the stampings are hung on overhead conveyors which carry them to

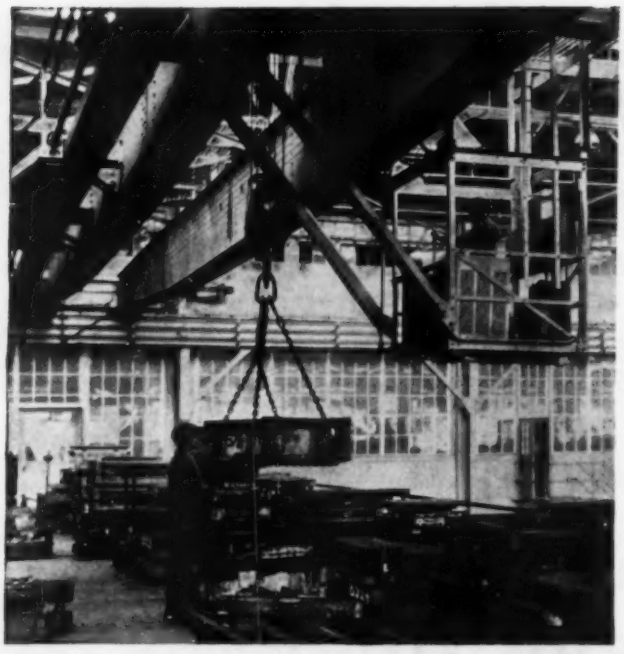


Fig. 3—One of the cranes, showing operator's carriage which travels along with the hook

particular part receive their first forming in the presses nearest the steel storage section, and then are put through the succeeding presses along the row until all the operations have been completed. For stampings used in assembly as rapidly as they are formed, the die set-up remains unchanged as long as the part is in production. Smaller parts that go through fewer operations and are turned out in quantities far greater than can be absorbed in the daily production are made in large numbers and stored. Dies on this series of presses then are changed to turn out other parts. Fig. 4, showing sedan side and coupe rear panels, gives an idea of the large size and deep drawing performed in some operations.

One of our objectives has been to minimize handling operations, especially on large parts. The layout, therefore, is designed to pass the sheet through the presses and deliver it by conveyors directly to the assembly lines, or, in the case of some parts produced too rapidly for absorption there, to temporary storage. Some parts requiring operations not done on the presses are shunted by conveyors through departments where these operations are performed. Thus, if the body in production does not run into sufficient quantity to warrant the expense

Fig. 4—Coupe rear panel and sedan rear quarter panel, examples of the large deep-drawn stampings produced. All moldings are integral

the assembly departments. Each of the 175 presses is equipped with a centralized lubrication system, eliminating some dependence on the human element and resulting in a marked economy in greasing, labor, and press repairs. Between the rows of presses are galleries, as shown in Fig. 2, used for the storage of dies. Each of the bays is served by 15-ton Whiting overhead traveling cranes, used to place dies on or remove them from the presses and to carry them to and from the storage galleries. Each crane has a capacity sufficient to handle the largest die or the heaviest part of any press. Certain of the cranes are provided with cages (as shown in Fig. 3) that move along the bridge with the hook. From this cage the crane man can see the work he is handling at all times and, therefore, is less dependent upon signals from the men moving the dies. Accidents to men and equipment are thereby minimized.

Fig. 5 — Band-type metal saws used for cutting flash from some stampings. Scrap pushed onto the belt conveyor is carried to a baling press in the basement

Fig. 2 shows the arrangement of presses in rows. They are located close together, but with ample operating space around each press. The close arrangement conserves floor space and also reduces handling operations. Stampings from one press are delivered directly to the operator on the next succeeding press for the following operation. Presses, therefore, are arranged in operation sequence, not by classes according to type of work. Sheets for a

of shearing dies, the parts are shunted through a sawing department where the flash is removed. Parts are supported on the conveyors in some cases by special hooks.

In Fig. 5 is shown one of the two rows of metal sawing machines on the second floor of the body assembly building. Chain conveyors from the press shop pass between the two rows of saws used to remove excess metal. Scrap from the sawing operations is shoved down the incline at the back of each saw onto the belt conveyors, serving each row of sawing machines, and is discharged to the basement of the building for baling.

Scrap from the various trimming presses in the main press department is dumped through holes in the floor onto a belt conveyor which discharges near a baling machine. Baled scrap is pushed onto a small elevator and discharged onto a bar conveyor which carries it to a point above the railroad track where the bales are discharged into open freight cars and returned to the steel mills for remelting. Use is made of lift trucks and skids, especially for handling small parts which it does not pay to hang separately upon a conveyor. The larger parts discharged from the presses are hung upon a chain conveyor that rises to the second floor and traverses the

initial body assembly department, where the major metal parts are assembled. Parts produced in excess of immediate requirements pass through this department without removal from the conveyor and go into an adjacent building for storage.

Many small parts, such as door and window flanges, must be punched and countersunk for attachment by means of small screws. Formerly this work gave considerable trouble and tool breakage was very high. After considerable experimentation the revolving spindle press shown in Fig. 6 was developed for doing this work. The punch face is ground at a 5 deg. angle and cuts out the slug with little strain on the slender punch.

The first operation in assembling the rear portion of the body is the welding of the back panel to the two rear quarter panels. These three parts, each produced as a single piece, are delivered to the welding machine pictured in Fig. 7. The three parts are placed in position in the machine, and the water-cooled welding dies clamp the edges to be joined in correct relative position as the fixture is closed. Application of current then produces two butt-welded seams, running from sill line to roof, in

Fig. 6 — This rotary-spindle punch, used for making screw and nail holes, gives rapid production with minimum punch breakage

approximately ten seconds, forming a one-piece assembly which is transferred to a wheeled buck. This buck is placed in a floor-type conveyor line where any excess metal at the seam is ground away. The area around the seam then is rubbed smooth so that it will take an even coat of paint and be invisible in the finished body. In the next operation the roof side panels are arc-welded to the rear assembly in the jig shown in Fig. 8, after which the assembly is placed on an elevator and carried to the third floor.

Welding of the cowl assembly is performed after fastening the parts into jigs. A special portable gun-type spot-welder, one of which is shown in Fig. 9, was developed for this and similar work. In this assembly the side panels of the cowl, which are made in one piece with the windshield (front corner) pillars, are joined to the dash and the heavy gauge front-end frame by spot-welding. The top panel of the cowl, in the body here described forming also the top section of the fuel tank, is bolted to the dash and the cowl side panels to permit removal for service.

This all-steel front is the bulwark of coach work by Murray. It is made as strong and rigid as possible, in order to resist the fore and aft thrusts resulting from rapid acceleration and to four-wheel braking, and to resist side thrusts in fast cornering. As the front doors are hinged on this unit, it also must be strong enough to maintain the correct alignment throughout the life of the body. The balance of the body, however, is so designed that it will flex and weave with the chassis frame and prevent excessive strains either in the body or the chassis frame.

With the completion of the cowl assembly the body shell is ready for application to the wood frame. All parts of the latter are machined at our own wood-working plants at Memphis, Tenn. and Bay City, Mich., and

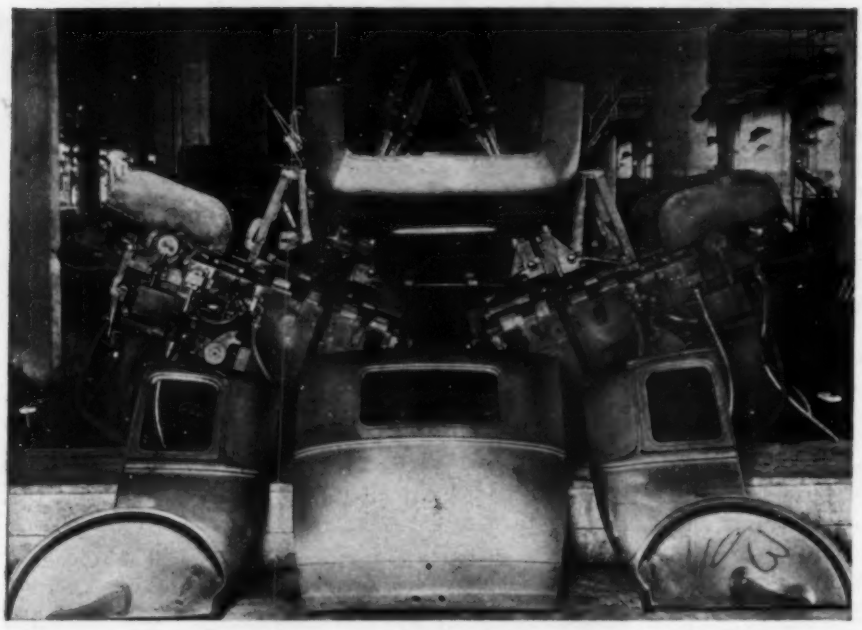


Fig. 7—Butt-welder which makes two seam welds from roof to sill in about 10 sec., joining the three parts shown into a one-piece assembly

arrive at our Detroit plant ready for immediate assembly.

Various parts of the body frame and roof are assembled in jigs and are held in place by screws. Glued framing joints have been abandoned, for they add little to the strength of the body and ample strength is provided by the screws and metal reinforcements. Moreover, in service the glued joints are likely to loosen, pulverizing the glue, which then acts much like resin, causing squeaks to be accentuated. Instead of glue, an anti-friction compound, which does not harden with age, is placed between the wood members at every joint. Parts then can move slightly relative to each other without noise.

Fig. 8—Arc-welding roof side panels to the rear and quarter panel assembly

Laminated oak main sills and cross sills, with one-piece steel seat pans form the underbody. Although laminated sill construction is somewhat costly, its contribution in resilience and resistance to warping and splitting warrants this expenditure.

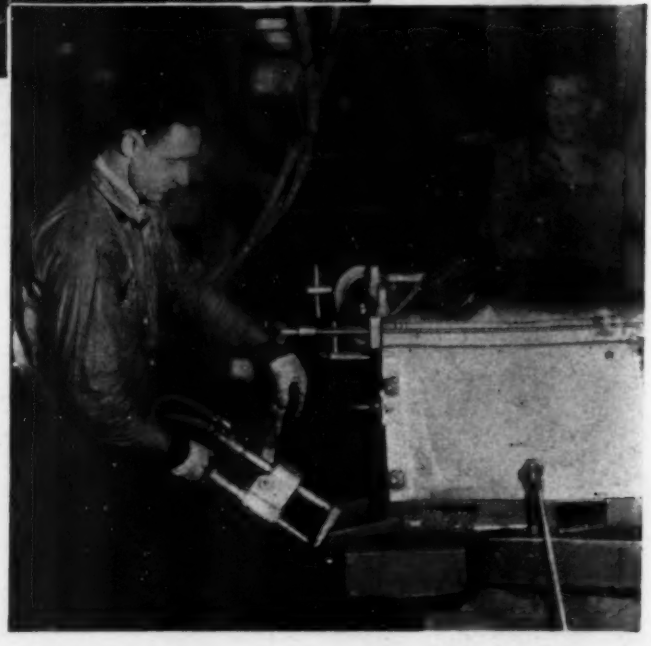
A feature of the roof is the double-rail, woven wire construction. The double rails, known as the main roof rail and sub-roof rail, give greater strength with lighter weight than a single heavy roof rail would give, thereby lowering the center of gravity of the body and contributing to the roadability of the complete automobile. The woven wire deck foundation has been a Murray standard for the past few years. It was developed to replace and overcome a number of difficulties encountered with the old slate-type roof. This type of foundation is light in weight and firm, yet has a great deal of flexibility.

Various sub-assemblies of the body frame and the metal cowl assembly are fastened together in the jigs, illustrated in Fig. 10, and designed to hold various dimensions to the necessary limits. Cowl assemblies are delivered to the jigs by the overhead chain conveyor shown, and the body frame is pushed out of the jig directly onto a roller conveyor from which it is picked up afterward by cradle hooks and carried on a chain conveyor through a booth where it receives a spray coat of preservative compound. This compound is intended to protect the wood from checking or other deterioration throughout the entire life of the car. It is also an effective means for preventing the attack of wood-destroying insects and fungus growth, especially in tropical countries.

Squeaks are caused by friction, and the best way to eliminate squeaks is to prevent frictional contact. We, therefore, use either a felt-like material or a heavy application of anti-friction compound between the wood frame members and the metal panels. This precaution is quite a forward step in body building and eliminates considerable service difficulty.

The frame is now ready for the applica-

Fig. 9—This gun-type spot welder is used to weld the dash, the one-piece panels forming the side of the cowl and the windshield pillars



tion of the metal body shell, after which all four of the ready-assembled doors are hung and adjusted. All these operations are performed while the body frame moves slowly along on a slat conveyor line. Doors and other sub-assemblies are delivered to this line by chain conveyors from the various sub-assembly departments.

Hardwood door frames come from our Memphis plant already assembled. They are unloaded from the box cars at one side of the press department and there are hung upon a chain conveyor that carries them into the door-making department. Into this department a chain conveyor, leading from the press department, delivers the metal door parts. "L" section steel reinforcements are applied to the pillar faces and the edges of the outer panel are flanged over the extending edges. The flanging operations are performed in standard presses fitted with dies which receive both the wooden door frame and its stamped metal outer panel and hold these parts in correct relative position while the flanging operations are performed. Door assemblies are drilled for the attachment of the door handles, locks, and window regulators and the two latter parts, delivered from an adjacent store-room, are attached ready for operation. Finished doors then are hung on the chain conveyor and are delivered to the body assembly department where they are attached to the bodies. The latter continue along the slat conveyors, finally reaching an elevator in the state known to the industry as "body in white," ready for the application of paint and trim. They are elevated to the sixth floor for the painting and trimming operations to be described in another article.

Fig. 10 — Framing jigs in which the wood roof and underbody units are assembled to the steel cowl and windshield unit

Stopping Waste in Tool Service

By H. L. Bradford

ONE OF the obstacles to efficient management that remains unsolved in the average shop is that of establishing standard shapes for cutting tools and regrinding them in the tool crib. It is true that we have either adopted the shapes Taylor advocated, or have modified them to suit our own ideas. It is also true that in most shops we grind new tools and routine shapes for repetitive production purposes in the tool crib. But in these same shops we do not grind the tools for the tool-maker, or for anyone other than specialists on mass production work. In large general machine shops very little progress has been made in that direction, and so little headway, in general, is being made that one wonders why, of all the shop problems, this one should be the "sticker."

There are really efficient superintendents and managers who have instituted many reforms, but not this one. If they are asked why, they answer that "the men object." An answer, but not a reason, because men have objected to practically every innovation in shop practice. These executives are not "it can't be done men," but they admit they have not attempted to do it seriously, and will declare that it is the only problem that they have not been able to solve.

There is no basic difference beween sharpening a drill, a milling cutter, and a lathe tool; each requires a certain rake and slope in order to cut efficiently and this rake and slope must differ for different materials and conditions. Management insists on grinding drills, and milling cutters, and does so successfully. It is now routine that they shall be ground in the tool crib. We have not been able to do the same with lathe tools, and an analysis of the situation points to three factors as being responsible: first, the lack of a real production grinder that can be set up to grind a single tool economically; second, the special tool, of which the tool crib man, usually not a mechanic, has no knowledge either of its use or requirements, because it is not on the standard list; third, the feeling on the part of the executive that there are not means at hand to carry the system through successfully. Rather than risk having to recede from a position, he prefers not to make the advance.

A method of grinding a single angle or a single tool can be and has been worked out successfully in some shops. The new tungsten carbide tools cannot be ground on ordinary wheels, so they must perforce be sent into the toolcrib, and to the writer's mind this is one of the outstanding advantages of these new tools.

A drift pin should not be oiled. It should be used to secure alignment, not to enlarge a hole. Care should be taken in driving out a drift pin to see that other workmen will not be struck if the pin flies.

EXECUTIVE · FORUM

Who Should Control Routing?

THINGS had not been going smoothly at the Masfield Foundry and Machine Company. Customers' complaints on deliveries had filtered through to old J. J. Masfield himself, who for the past three years, had been content to allow his junior executives to run his business. Only occasionally, when the usual smooth functioning of the plant seemed decidedly out of gear, did J. J. take a hand in details of operation. Now, he had called into his office the two men directly concerned with the present difficulty: Thomas McMurray, his veteran works manager, and Harry Bowman, his enterprising, young, production engineer.

"To avoid generalities, I will base this discussion on a specific instance," commenced Masfield. "Last Saturday on the golf course, George L. Pratt tackled me about his order for molding machines. In fact, he talked so much about it he made me miss three putts. When I came in this morning, I had this order looked up, and I find it is actually ten days late. Now what is it all about?"

"To tell the truth, J. J.," replied McMurray, "since Bowman here was made responsible for routing and deliveries, I do not give much more attention to shipping dates than you. I see that the work is handled in the most efficient manner and take care of shop administration, but I figure that the reason for a separate routing department is to relieve the shop of that much worry."

"And that is the real cause of the trouble," spoke up Bowman. "Since I organized the present method of scheduling, the prevailing attitude in the shop has been, 'Let Bowman do it.' The operating department seems to have washed its hands of all questions dealing with deliveries. This, of course, is all wrong, since no system is workable without its co-operation. According to the present set-up, I have absolutely no authority in the shop. If the proper priorities are not observed, my only resource is to call them to Mr. McMurray's attention. Each day, he gets a list several pages long of parts overdue in various departments. Indirect control of this kind does not produce the desired results."

"Well now that we know what's wrong, what constructive suggestions have you to remedy this situation?" asked Masfield.

What Do You Think About This Executive Problem?

Industrial practice in the control of routing varies greatly. This function in some plants enjoys the prestige of a separate department, reporting directly to the chief executive, while in others, it is subordinated to virtually a clerical subdivision.

Should those responsible for routing be given a high degree of independence or be closely tied in with the operating department? You are invited to submit your views on this question. *American Machinist* will pay for all contributions accepted.

"The shop clerks should be a part of the routing system and report directly to me" advised Bowman. "I would make them responsible for the sequence of the jobs in their respective departments. The foreman would still have direct supervision over his men and their methods but would be guided by the clerk in regard to his schedules. This would obtain a direct control."

"Before Bowman's time, we did not have this complicated system," stated McMurray. "All shop functions were entirely up to me, and if my memory is good, we managed to keep the customer pretty happy. I can see merit in a more accurate method of control, but I do think, that any such system should come directly under the works manager."

"But the tendency of modern management has been toward functional control," objected Bowman. "It has been demonstrated that the one-man shop does not promote the maximum efficiency. Co-operation is essential, yes, but not concentration of all shop functions under one head."

DISCUSSION

OF PREVIOUS PROBLEMS

Who Should Do the Estimating?

Whether the foreman should estimate depends on a great many considerations, some of which were not touched upon. First there is the amount of estimating, which depends on the character of shop. One extreme is a jobbing shop, where every job must be estimated. Of course the foreman should not do it here as he would have no time left for foremanship. At the other extreme, is the straight manufacturing shop, that does not want special jobs and as a rule refuses to estimate. If occasion demands an estimate, the foreman would be at sea, due to lack of practice or experience in estimating. In the large number of shops between these extremes, the foreman may profitably be called upon to estimate the labor hours only, where the amount of estimating is not too great a drain on his time, and where it would not pay to engage a highly skilled man for this work. It is assumed that the foreman would never be expected to figure the material, nor compile and extend the items.

Another governing consideration is whether or not the shop depends on this class of work as an important part of its revenue. In the latter case, it is just as well to let the foreman cover himself by putting in an outside figure, which generally will not drive away the business. But in the former case, competition will be keen, and it will be well to have an experienced estimator consult with the foreman and on the larger jobs to have a conference including also the superintendent. If the shop has a time study man or a rate-setter, as for paying bonus, this individual can originate figures as a basis for discussion. With any system, a very important adjunct is a parallel column to compare hindsight with foresight, and it is surprising how many shops overlook this simple but powerful aid.

—J. MALVERN BENJAMIN, *Consulting Engineer, Philadelphia, Pa.*

Should a Plant Take an Annual Inventory?

When knowledge of anything concerning the running of the business is lacking, steps must be taken to gain the information. But, it seems to me, that the large amount of time and work, devoted to taking the annual inventory of stock, parts and plant, is a great waste. It is true that the information obtained is necessary for certain bookkeeping and for closing and opening the fiscal year. For economical operation, knowledge of the amount and condition of the stock on hand must be instantly available to the production manager, stock keepers, and other interested parties. By using some type of perpetual inventory, the amount on hand, location, and condition of each item is shown by the entries made on its card as the supply is augmented or decreased.

When a system of this kind is rigidly adhered to, an inventory of the whole plant can be taken easily and quickly by collecting the balance totals from the cards for the items at the close of any working day. Thus, no shutdown with its loss of production will be required. The fixed charges and a large part of the other overhead charges go on just the same, when the plant is idle as when it is running full time. Every hour of production lost means that the remaining productive time must carry a heavier overhead load before any profit can be earned. Since this is so, no productive time should be sacrificed to the counting, weighing, and measuring of materials and parts, as the production manager should have the accurate figures at his fingers' tips.

—L. O. BROWN, *Toolroom Foreman, Holcomb & Hoke Manufacturing Company.*

Fitting the Older Worker for His Job

The question of the older worker is a very serious problem. The typical advertisement offers a good job to a man between twenty-five and thirty-five. It is rather disconcerting to conjecture what is to happen to the man criminal enough to enter his forties. Some of these veteran offenders have remained loyal to sinking ships, and have been among the last to leave the derelicts. They are then faced with the alternative of raiding a slender capital, in the hope of ultimately securing a post suited to their qualifications, or of taking any sort of a job which may be offered, on the ground that any bread is to be preferred to no loaf at all. The only fly in the ointment when they come to compete for a likely post is usually the question of age. The ability to turn out the work satisfactorily and the benefits derived from a large and useful experience, are to go by the board for the sole but all-sufficient reason that they have had too long an experience in delivering the goods.

Should reason succeed in asserting itself, the man in his forties need not fear for his future. Unfortunately, however, in engineering, where reason should occupy a paramount position, prejudice is hydra-headed. No one considers an elderly headmaster, banker, scientist, scholar, clergyman, or manager of industry, to be incapable. The ordinary engineer of forty-five, however, is an old-stager, and the serious, constructive suggestion is that the older man be found, as a reward for the days of past usefulness, a "cushy" job as a glorified consultant. This is certainly a considerable advance upon what usually obtains, and is a most suitable provision for a tried and trusted employee well on in his fifties.

But for the man in his very prime, there should be no need to consider either his discharge

or his transfer to less onerous duties, provided of course, his work continues to give every satisfaction. Many men are at their zenith when experience has matured; their output will compare favorably both as regards quantity and quality, with that of the younger men, and they are generally highly dependable. The added sense of responsibility, too, can be a most helpful factor in aiding efficiency and effectiveness. If it be contended that they tend to become rutted, lacking in initiative, and unenterprising, the answer is that the same objections can often be leveled against those in the coveted twenty-five to thirty-five range. It is less a matter of age than of temperament.

—W. R. NEEDHAM,
Stafford, England.

Should Estimates Be Given Operatives?

I do not believe so; there is no need of supplying all the men with the firm's private affairs. The plan which we have here, and one which has proven successful, is to let the foreman of each department know just what was figured on the particular part and operations in his room only, putting it up to him to follow it through. Some men have a tendency to talk too much, making it unwise to put all your facts and figures in the hands of the workman; the foreman is paid for watching such things and therefore is the only man on the job that should know. This has been a practice here for years and has always worked out well. I believe if some firms would try this method, it would certainly work out to their advantage.

—CHARLES R. WHITEHOUSE,
Holtzer-Cabot Electric Company.

Who Should Do the Estimating?

The first essential in all successful estimating must be the unrestricted co-operation of all departments. The foreman would be qualified to supply the information on labor costs but should not be saddled with a matter that can be reduced to routine by standardization.

A technical man would be most suitable for co-ordinating, analyzing, standardizing, and tabulating the components which complete an estimate. He is most likely to underrate emergencies which occur from local and shop peculiarities. The estimator should be 60 per cent technical and 40 per cent practical, of wide outlook, and capable of recognizing the foreman's practical knowledge.

Direct reference to the foreman should be necessary only when a difficult operation in an estimate is found, as the majority of the figuring is readily solved by comparison with past performances. The estimator should be held responsible for the success of any order that results from his figuring. By this means, he is stimulated to careful consideration of all points and the adoption of the most successful.

—JAMES G. TURTON,
Worcester, Mass.

Who Should Do the Estimating?

A trained technical man, with records of past quotations and corresponding cost figures available, should make the best estimates. Estimates, based on records with the least amount of guessing, will come nearer to the correct amount than by any other method. When unusual work is to be quoted on or when a very small lot is required, the judgment of foremen would be of value. They could give a fair time estimate on such points as set-up time which often eats up all the profit on small lots.

As superintendents are often blamed when the profits are small, they have a right to know what the prices asked are on new work. It is a good plan to have the estimator complete his estimate and then go over it with the superintendent. This procedure will keep the estimator well informed on shop conditions and give the superintendent a chance to make corrections. The responsibility will then rest between both both these men with the greater part of it on the estimator.

—L. F. SWENSON, *Industrial Engineer,*
Perkins Machine & Gear Co.

Equipment Replacement in Slack Periods

The slack period affords the maximum of time and undivided attention for the replacement of equipment. It also offers new equipment at minimum prices and quickest deliveries. Moreover the benefit conferred upon the community by the ordering of new equipment reaches its greatest value during depressed business conditions.

They, who advocate pulling in horns and waiting cautiously till they can tell the trend, thereby support a policy that forfeits the services and privileges of leadership. This policy never helps to transform a slack period into a busy one. The progression of those who follow it is likely to be comparatively as slow as that of the shelled creature that does pull in its horns.

Whatever personal losses we may suffer, certain facts are basic. One is that every slack period has been followed by a busy one; another, that other things being equal, those who are best prepared win most. Further, no business has ever been created by drawing in horns and waiting, and none is likely to be. Obviously if we all pulled in our horns and waited for business to improve, it never would.

Great leaders are undeterred by slack periods or even panics. The year 1893 was a panic year in the U. S. A. It has been described as the year "of no business." In that same year the National Cash Register Co. broke all its previous records by selling 15,487 cash registers, the greatest number of sales it had ever achieved in any year. John Henry Patterson was the business "Marshal Forward" then commanding that company and his motto was "Always ready."

—J. J. WOFFINGTON,
Leamington Spa., England.

How One Shop Reconditions Locomotive Superheaters

By J. O. B. PALMER

Foreman, El Paso Shops, Southern Pacific Company

MOST locomotives are equipped with superheaters, so that the repairs for this branch of work have made possible the development of efficient tools and reconditioning equipment. At the El Paso shops of the Southern Pacific Company, superheater repairs are handled in a department that is operated independently of all other departments.

When an engine is dismantled at the pit, the superheater units are transferred to a truck equipped with roller bearings, and made especially for transporting the work from the back shop to the department for repairing superheaters. The first operation is testing the units to determine their condition. The test pressure is generated by a small pump, compounded so as to put a pressure of from 350 to 450 lb. on the unit, enabling the detection of leaks. A view of the testing equipment with a superheater unit connected to it, at the right, is illustrated in Fig. 1. In use, water is allowed to flow into the unit, then the pump is brought into operation to build up the required pressure.

While under pressure, the unit is hammered to detect any cracks or thin spots. Units that are found to be defective, are placed to one side for repairs. If the superheater is wanted in a hurry, and if one or two units are found to be defective, other previously repaired units are substituted for the faulty ones, so that there will be no delay in putting the reconditioned superheater in service.

Acetylene welding is used extensively in repairing the units. In applying new ends, the units are first placed on the bench shown in Fig. 2. Here, the part to be cut off is marked, as is also the length of tubing to be welded in its place. By aligning both parts at one setting, it is possible to build up a unit to the same size and shape as it was originally. After being marked, the bad part is cut off and the unit is ready to have the new end welded in place.

A special form of welding fixture holds the parts butted together and in proper alignment. It is shown in Fig. 3 with a superheater unit in place. It will hold units varying from 12 to 21 ft. in length and from 6 to 38 in. in height, and boiler tubes up to 5⅛ in. in diameter. The carriage of the fixture is revolved on two car-wheel tires, which rest on rollers mounted on the

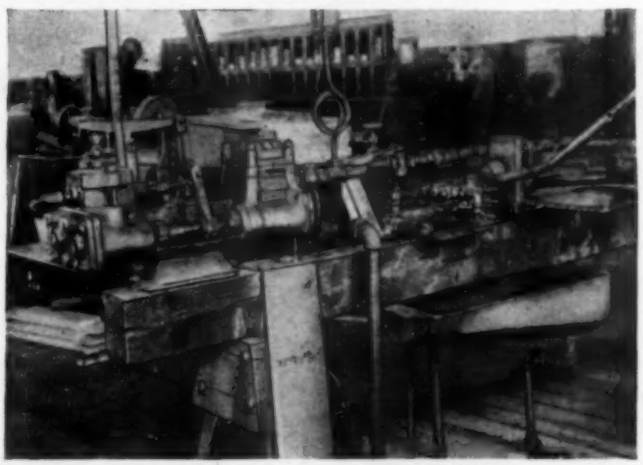
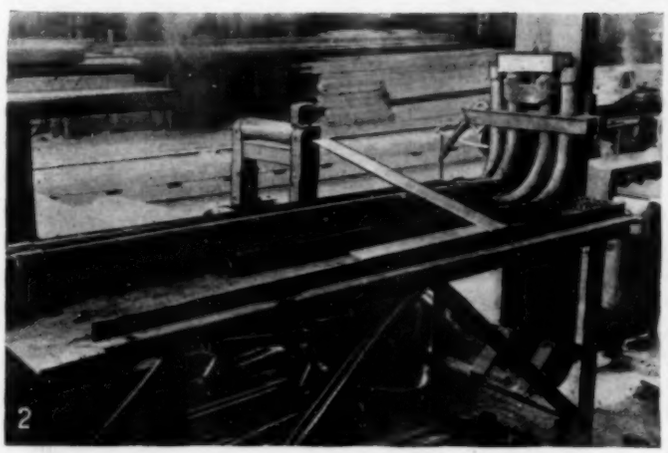


Fig. 1—A testing device for superheater units. A compound pump builds up and maintains pressure at from 350 to 450 pounds



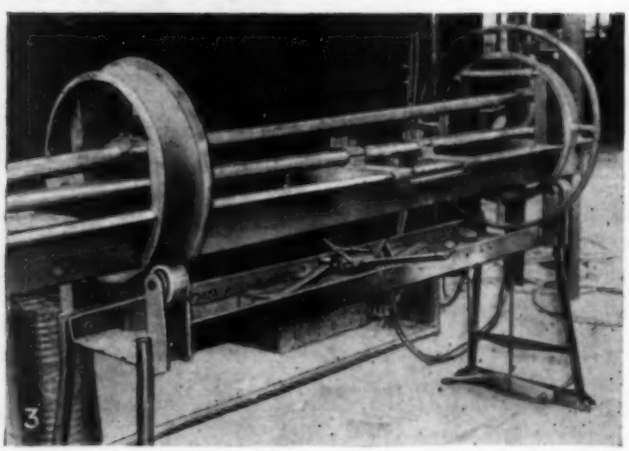


Fig. 2—When superheater units require new ends, the points at which the bad parts are to be cut off are marked in this machine, as are also the lengths of the tubing to be welded to them. Fig. 3—Fixture for holding superheater units while new ends are being welded to them. The parts to be welded together are butted and rigidly clamped

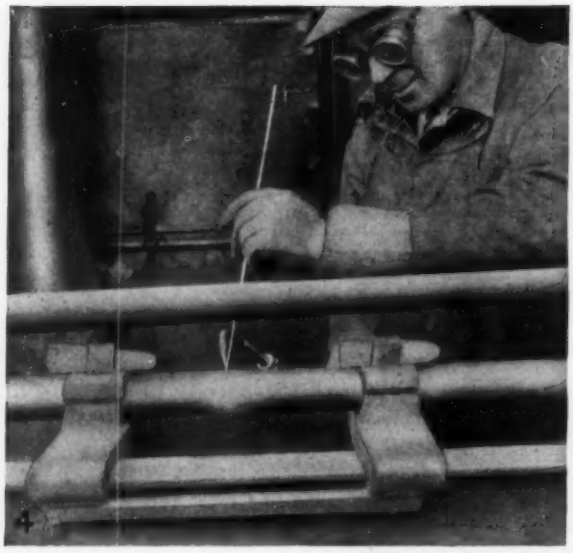


Fig. 4 — Close-up of a butted joint ready to be welded. The work-holding section of the fixture is mounted upon rollers and is revolved as the welding progresses

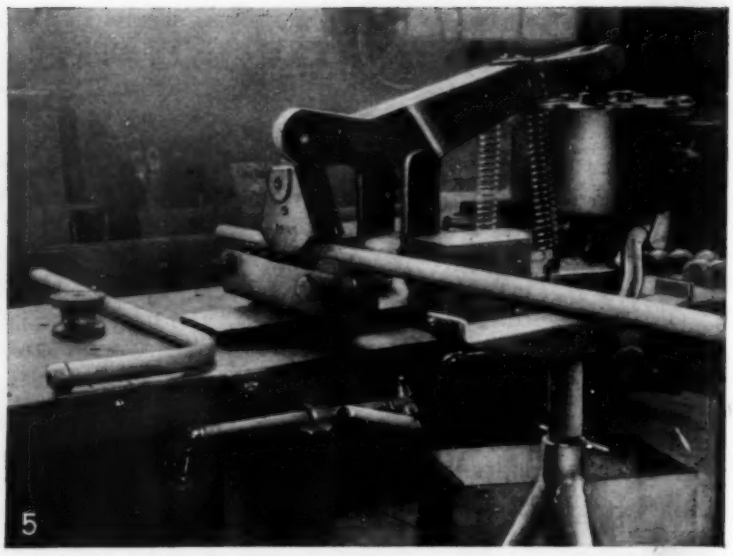


Fig. 5 — An air-operated machine for bending superheater units. The units rest on rollers and are bent by a formed block operated by the piston of the air cylinder at the right

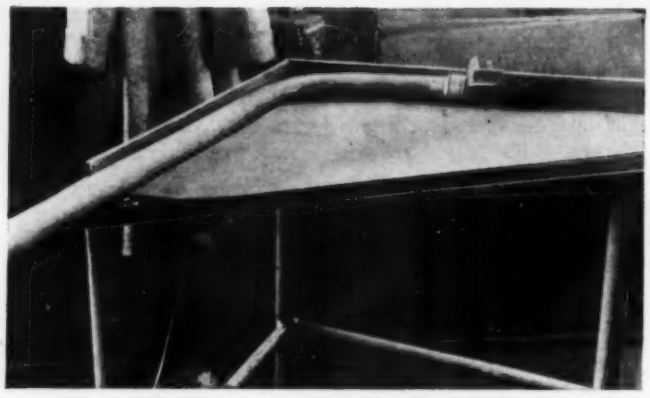


Fig. 6—A gage plate for checking the squareness of the bend. The length of the bent end is checked by a sliding gage on the angle iron at the back

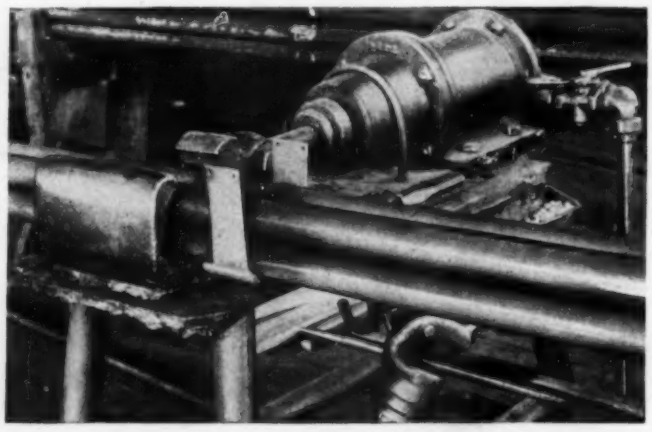


Fig. 7—An air-operated banding machine. The units and the bands are held tightly and the ends of the bands are folded over each other. Riveting is done by a portable air hammer, a specially designed dolly being held under the rivet heads

base. A large handwheel is welded to the tire at the right to facilitate rotation of the carriage.

In Fig. 4 is shown a close-up view of a butted joint in the carriage, ready to be welded. The carriage is revolved as the welding progresses. An air-operated machine for forming the bends of superheater units is shown in Fig. 5. The air cylinder at the right is so positioned that its piston will operate the lever of the machine. The leverage is four to one. The unit to be bent rests on two rollers, and a form block carried by the lever is forced down upon it, making the bend. At the left, a unit so bent can be seen.

Inspection of the bend to check its angle is done on the gaging plate shown in Fig. 6. It has angle irons attached to two adjacent sides, and at a right angle with each other. The unit to be inspected is placed on the plate so that its long end lies flat against the angle iron at the left, while the end that has been bent strikes the other angle iron. In this position, any error in angle will be detected. The angle iron against which the bent end strikes is graduated, and is provided with a sliding gage, enabling the length of the bent end to be checked.

After the units have been welded, they are banded in the machine illustrated in Fig. 7. The machine consists of an air cylinder, the piston of which is provided with a formed block that forces the work against a stationary jaw. Both the block and the jaw are shaped to fit the assembly. After the band has been placed in position, the piston is operated to hold it tightly in place and to close one end over the other. The ends of the band are riveted together by means of an air hammer, a specially designed dolly being placed under the heads of the rivets.

So much depends upon the proper reconditioning of these units, that many railroads prefer to return them to the maker for test and reconditioning. This practice, however, means either waiting a long time for the units or carrying a stock of spare ones, and both practices have their drawbacks. Generally speaking, any railroad shop that undertakes to do its own reconditioning, must be run efficiently, or expenses will get out of hand. This explains why railroads that do their own repairs usually install a special department for doing the work.

What COOLANT Shall We Use?

Securing the necessary balance between refrigeration and lubrication in a single medium is not possible, and any compromise fits only a limited number of applications

CHESTER B. LORD
Associate Editor, American Machinist

THE Progress Report of the Sub-Committee of the A.S.M.E. Special Research Committee on Cutting of Metals, contains a summary of the cutting practice of 75 shops. These particular shops are representative of leading manufacturers of automotive, steam, and electrical machinery, machine tools, and other mechanical products. It may, therefore, be taken as a cross-section of the best current practice.

As is usual with statistics, the conclusions arrived at may be construed to suit one's own opinion, but the report as a whole shows a diversity of practice based largely on personal taste and opinion, although, of course, local plant conditions, the rigidity of the casting, and other factors influence the use or non-use of a cutting fluid. On the other hand, some of the differences seem to be inexplicable. As for instance, why the same firm should use a certain cutting fluid on one type of machine and not on another, or why one type of fluid on a screw machine and another on a turret lathe.

In heavy turning cuts on low-carbon steel, for example, 17 shops did the operation dry, 27 used a water emulsion of some kind, and 19 used oil or an oil compound. Turning high carbon steel, seventeen did the operation dry, 21 used water emulsion and 20 used an oil mixture. All this work was done on lathes. On light or finishing cuts, the proportions were practically the same. On cast steel, which probably means castings, the proportions were 17 dry, 21 using water emulsion, and 14 oil compounds.

On the other hand when planing a heavy cut on low-carbon steel, 34 shops did the operation dry, 1 used an emulsion, 10 used oil compounds. In shaping, 31 were dry, 1 used water emulsion, and 4 used oil emulsion. The reason is quite evident as the shaping cut is short and intermittent and cooling is not necessary. The shops that used emulsion or oil probably applied it with an oil can so that it does not properly belong in the statistics.

In automatic screw machine practice, none were dry, four used the water emulsion, and 51 used an oil compound of some kind. On similar operations on a turret lathe the proportions were one dry, 29 water emulsion and 35 oil compound, why the difference in identical operations on different machines?

The general conclusion to be arrived at from a study of the report is that expediency, custom, type of machine, and size of the part being machined have more influence on the method used than do cooling and lubrication.

A study of the results secured under varying conditions of removing metal indicate that this operation, to be most successful, must be performed between certain temperature limits for each analysis of metal. It shows further that this temperature balance may be disturbed by either speed, depth of cut, by a clearance angle of the cutting tool, by vibration, or by the toughness or hardness of the metal.

These heat-producing factors may be compensated for, up to a certain limit, by using a coolant alone, a lubricant only, or a combination of both. In some cases we need some method of making the tool bite to get traction.

In a refrigerant the qualities we look for are fluidity and capacity to absorb heat. In a lubricant we look for oiliness and viscosity. Many substances, mineral, animal and vegetable, contain one or more of these properties, but no single medium combines them all to a sufficient degree to be used alone, and therefore we resort to mixtures. Emulsions and compounded oils, therefore, are simply the chemist's idea of a combination of the essential elements that will most nearly meet average machining conditions, and cover the widest range or are his idea of an economical mixture for the average requirements.

The report above referred to, states that the basic materials used in making up the numerous emulsifiable compounds include: water, alkali, animal fats and oils, vegetable oils, mineral oils, including kerosene, carbon tetrachloride, turpentine, sulphur, soap, white lead, beeswax, talc, lamp black, and petrolatum. Taking these in their order, the alkalies are to neutralize the acid fats, to prevent rust, and to act as one of the agents of emulsification.

Animal fats are used for their superior oiliness but are too expensive for general use. Hence, mineral and vegetable oils are substituted.

Vegetable oils possess a high degree of lubricating quality and are superior to either mineral or animal oils where a high finish is required. A drawback to their use is that they are poor conductors of heat, and further, that they oxidize rapidly and gum up machines.

Castor oil is one exception to this rule. It is non-drying and has the highest viscosity of any fixed oil. It also has a very high oiliness, or property of clinging to the metal. It is not soluble in kerosene or other mineral oil, but will make a stable mixture if lard or rape oil is added.

Kerosene is a coolant, but what function carbon

tetrachloride performs is not quite clear, unless it helps in emulsifying, acts as a solvent, or is used as a germicide. Turpentine is also a coolant and counteracts viscosity and lubrication. Sulphur also counteracts lubrication and is used on high tensile steel to make the tool bite. Soap is an emulsifying agent, white lead, talc, beeswax, and petrolatum add body and are lubricants. Lamp black is probably a substitute for graphite, which is also a lubricant. It also has the property of clinging to the metal.

Breakdown Causes

On the other side, we have two distinct types of metal; one is hard, the other tough. The degree of hardness, and the quality of toughness cover a wide range, but in general, one is characterized by chips that break off in short lengths, and the other by chips that tear off in ribbons.

With the first class of material, the tool breakdown is usually caused by vibration battering the sharp edge of the tool, followed by a further breaking down and heating of the cutting edge through dullness and abrasion. With the second class of metals the breakdown is usually caused by heat alone. The tool is pressed hard against the work not only by the feed, but also by the chip, which impinges back of the cutting edge. If the cut is deep and the feed coarse, there is insufficient tool surface to dissipate the heat, and the tool fails, usually at the center of the cut. Hard metal dissipates heat more rapidly than tough metal, but the vibration is greater on hard metal. It lacks the restraining pressure of the long chip.

It is evident that the vibration of hard metal is caused by the intermittent power of the feed forcing the tool into the metal. The tool resists momentarily, then digs in, and springs back, and repeats the operation as the resistance varies between the feed and the metal. On the tough metals the action is quite the opposite, the natural tendency of the tool is to dig in, and after it has dug in to a certain extent the natural spring of the tool withdraws it with a snap. This performance is also repeated, but the rate of vibration is much slower than with hard metal.

The problem is then, to furnish not only each class, but almost each variety of each class, with a medium that will either cool, lubricate, or perform both functions in proportions demanded by the nature of the metal being cut. It is self evident that a brittle metal does not requite much lubrication. In some cases it requires only a coolant, and in extreme cases it requires something like turpentine that will give cutting traction or bite. This is the opposite of lubrication. Soft metal, on the other hand, requires a lubricant so that the tool will not penetrate too far and hence will not spring back so far. To do this the fluid used must have body enough, oiliness enough, to cling to the metal and form a lubricating wedge, and must still be low enough in viscosity to conduct the heat from the cutting edge and the work.

The action sought by using lubrication and its opposite, traction, is to damp the vibration of the tool, and much of our dissatisfaction with coolants is caused by using a combination that either cools without damping the vibration, or that dampens without giving sufficient refrigeration to remove the heat. On the whole this explanation may not help the general problem, but it may help the specific case.

The vibration caused by an intermittent cut, or by insufficient support of the part being machined, must be cured by mechanical means and is, therefore, not considered here.

We may and do rough turn large shafts or massive castings dry, because the speed is relatively low, the steel is usually soft, and both the machine and the work are too heavy to vibrate in unison; hence one dampens the vibrations of the other. Another reason is that the tool is usually strong enough to break off the chips as it digs in and springs out, and in this way it dissipates the heat to a considerable extent. If water is applied to the cut, it may be speeded up by possibly 40 per cent and the cut will be smoother because, generally speaking, the greater the cutting speed, the greater the tendency of the tool to follow a straight path. The digging in cycle of the tool has been reduced, and also because water is a lubricant to a small degree. If the water is then shut off, and ordinary machine oil is used instead, the cut will become still smoother, because the oil prevents the tool digging in as far, and hence the amplitude of its spring is lessened. Under these conditions the chip becomes continuous.

These two examples illustrate the effect of refrigeration and lubrication, but there remains one other condition. At times, on high tensile steel, in screw machine work, the tools dig into the work at some places and ride it at others, and the surface of the part looks as though it had been gnawed. Our first guess is that the material is full of hard spots, but a hardness test does not bear this out. We find that we can machine the part much better dry, but the quantity is large, it is a screw machine part, and it should be done on a screw machine. If we add finely ground sulphur to our oil we find that the tool then has traction, or bites, and that the finish is even enough to meet reasonable allowances for grinding, but not smooth. Here again we have two things working one against the other, the sulphur tends to cause the tool to bite, and the oil tends to prevent it. The nature of the metal has caused the slowing down of the

Next Week: *A Special Number*

For the first time in 53 years of continuous publication, the *American Machinist* proposes to dedicate one number to the work of one industrial plant. Except for current news and some of the more popular departments, next week's number will be comprised of authoritative, signed articles covering in detail the conception, layout, building, and tooling of the new Allis-Chalmers Model U Tractor Plant. That this project was planned and carried out in the face of pessimistic rumors of depression, that the plant is equipped with brand new tools from stem to stern, and that it is already operating profitably and to capacity, are any one of them reason enough for this departure from tradition.

cutting speed sufficiently so that cooling requirements do not predominate.

The ideal cutting compound then, is one that will both refrigerate and lubricate at either high speeds and small feeds, or low speeds and heavy cuts. If we are using a water emulsion at high speed the chances are we could get a smoother surface with oil at lower speeds. If we are getting a satisfactory finish with oil, it is quite probable that we can machine at a higher rate with an emulsion. Using a single medium or single oil the ideal can nearest be met with by sperm, or lard oil, but it is expensive, and we do not always get it pure. Lard oil contains a high degree of oiliness which makes it cling to the tool and work, it has lubricating qualities, traction qualities, and is about the best refrigerant among the oils.

Milk, for some reason, seems to have this same characteristic. It is said to be useful on tough copper and on chrome vanadium die-blocks for drop forgings, allowing the use of either carbon or high-speed steels for die sinking, Personally, I have had no experience with it.

Castor Oil and Kerosene

In my own experience, the best combination I have found is castor oil and kerosene mixed. Here, kerosene is almost entirely a coolant, and the castor oil has the greatest viscosity and oiliness of any fixed oil and imparts a fine finish. In this case the two oils perform their functions separately and independently, because the two will not mix intimately, but do mix mechanically. The kerosene acts as a coolant and a tractive agent, and carries off the heat. The castor oil acts as a lubricant and prevents vibration. The result is a smooth, even, parallel cut. The kerosene must be replenished much more frequently than the castor oil.

We can add body to a coolant by decreasing the proportion of water, but we may or may not add to the oiliness by so doing. We cannot add kerosene to a lubricant to increase the cooling effect and still retain the lubricating value of the oil because we have diluted the oil and really have a heavy kerosene, or a very light oil. The same kerosene added to castor oil, however, does not destroy the lubricating value of the castor oil because they constitute merely a mechanical mixture and not a dilution.

Among the emulsifiable coolants, my personal preference is for an emulsified, sulphonated oil. Pastes contain a large amount of water plus many of the fillers enumerated in the list given in the report of the committee. Generally speaking, any emulsion in which the hands can be washed should not be used, as it contains too much free alkali and will not only affect the lubrication of the machine, but will rust steel products. Threads are in an entirely different category from other machine work for two reasons: First, it is the only operation where micrometer tolerances are demanded, with a single cut. Next, the cutting surface is extremely small. The tendency is to dig in, which demands lubricants, and the sharp point tends to heat, which demands refrigeration. Lard oil most nearly meets the requirements where a single pointed threading tool is used.

With die threading the conditions are different. Here, we have several cutting points, each of which takes a portion of the cut. Because of its shape it cannot dig in, and cooling is not as important as lubrication, even though the heat generated is considerable. The operation of cutting threads with a die is partly cutting and partly spinning. A finished thread will be larger in diameter than the original stock. The heat is produced by pressure and lubrication is necessary to prevent fusing. The operation is so short that cooling does not enter. The chief essential in this operation is viscosity, and therefore heavy oils, or even white lead and oil are used. Usually when these heavy oils or white lead are used, it is the viscosity of the medium when heated that is important. A heated heavy oil would have a lubricating value equal to a cool thinner oil.

Vibration does not enter in this instance because a thread die cannot vibrate; the heat produced is by pressure, and any breaking of the die or tearing of the metal is usually caused by the fact that the part threaded was so large in diameter that the metal did not have room to expand in the threads of the die, and therefore, eventually acted as a friction brake, and something had to go.

An example of mechanical damping of vibration is the use of a gooseneck tool. Its flexibility and shape prevent its digging in, but a close examination of the cut shows minute parallel lines caused by the catching and releasing of the tool. If a so-called water cut is taken, the ridges are still present, but are almost microscopic.

After all this discussion, we are apparently no nearer a solution of the question as to what coolant should be used than we were in the beginning, perhaps, because the qualities of the materials used, the feed, speed, and cut, and the cutting angles of the tool used differ in different places. I have, however, endeavored to point out the causes and show the effects of the different mediums that are available, and why they produce such effects.

The best way to solve an individual problem and to demonstrate the effect of different coolants and lubricants on a particular variety of products is to take a piece of the material and place it between centers. Start the cut dry; then use water for a short distance; then emulsion, then light oil, heavy oil and dry again. The differences will be quite perceptible. Of course, the speeds and flow of coolant must approximate actual conditions as nearly as possible.

Nickel Plate on Aluminum

By C. B. Gordon-Sale
Shefford, England

ALUMINUM die-casting alloys show marked superiority over zinc mixtures, and have been adopted to a great extent in the instrument industry. On certain types of apparatus that we manufacture, it was necessary that the whole shall have a nickel-plate finish, and the die-cast parts were difficult to plate. However, the difficulty was overcome by the use of an additional dipping operation after the usual cleaning baths. The solution used was as follows:

Nitric acid (Conc.)	68 per cent by weight
Sulphuric acid	30 " " " "
Ferric chloride	2 " " " "

The parts were allowed to remain in this bath for three or four minutes, after which they were given a dip in cold running water and then moved directly to the plating vat. There should be no delay between cleaning and plating or the work will be almost sure to come out patchy.

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions given at the foot of the page have been arranged

Foremen and the Wage Bonus

"THE foremen's meeting will please come to order! Unless I hear any objection, we will dispense with the usual order of business, and I will ask Mr. Blake, our personnel man, to take the chair. The topic for this meeting as you all know, is: 'Should foremen participate in the wage bonus?' Mr. Blake, will you please take the chair?"

"Thank you, gentlemen," began Blake. We will hear from Bill Smith first. He is one of our oldest foremen in point of service. Mr. Smith."

"Mr. Chairman, and fellow foremen, I have been with this company for twenty-five years, and it is not yet necessary to buy my loyalty. I am doing the best I can, and a few more dollars will not improve it, nor a few less impair it. That's all I've got to say."

"Thank you Mr. Smith. Now let us hear from our youngest foreman, Joe Cook."

"Mr. Chairman and fellow members. We are all human. Why shouldn't we take anything that comes our way. If a foreman goes around through his department and makes new tools, or changes operations so as to give increased production, he is working harder and is certainly entitled to a little extra. That's the way I look at it."

"Phil Waites, your regular chairman has the floor."

"Mr. Chairman, I don't agree with Joe at all. The men take the attitude that it is their increased efforts which produce the bonus, and they would resent sharing it with the foreman, because the foremen get a salary. I think Joe is dead wrong."

"The Chairman recognizes Mr. Graham, —Ed, for short."

"Mr. Chairman, I don't like to speak out at prayer meetings like this, but I think all the other speakers are wrong. It is not a matter of buying loyalty, it isn't a question of getting paid for a little more work, but it shows that the company appreciates men who are trying to increase the output and lower the cost."

"How does your assistant feel about that, Ed? We will listen to Tom Mason."

"Mr. Chairman. An assistant doesn't come under either plan. He doesn't participate in the bonus, neither does he get a salary. I don't think either the foreman or the assistant should share in the bonus, as it might be a temptation for some foremen, not ours of course, to allow the work to be slighted, or to get careless about the way the time is turned in. I have known of such things happening."

"It is nearly time to adjourn, will you close the discussion, Al?"

"Mr. Chairman. If a foreman can do more work than he is now doing, he does not deserve a bonus, because he is not doing his best. That is what he is paid for. A foreman is paid a salary. He is supposed to smooth the path for the workman. Taking any part of the money earned by the workman either places him on the same basis with a workman or makes a grafter of him. Any bonus given a foreman should be at the end of the year, dependent upon the prosperity of the firm. Thank you."

"Meeting is adjourned, gentlemen."

What is the answer? Who, if any, of the speakers is right? What are the factors that should govern the giving of a bonus?

Idea suggested by Charles R. Whitehouse, Chief Time Study, The Holtzer-Cabot Electric Company.

Foremen are invited to discuss these questions vital to their work; of course the

DISCUSSION OF EARLIER TOPICS

Who Shall Be Laid Off First?

IN LAYING off men, care should be exercised to make the adjustment as equitable as possible. Factors such as outside obligations or length of service should be considered, but only between men of the same grade or ability. They should not be considered to determine whether a high grade or a lower grade man is to be released. Employees who have shown themselves to be undesirable because of habits, attitude, or unreliability should be disposed of first. Their re-employment at a later date would probably not be warranted, thus eliminating this consideration.

Al's contention that it is poor policy to release a high-class man and retain a poor one is well founded. It is both unjust and unreasonable to lay off a man because of a greater salary saving, and its effect on the shop morale is detrimental. He cannot afford to lose his job any more than a lower grade employee and should be encouraged for his superior work rather than penalized.

It is important to hold good men as a nucleus for building up a force when the time comes. Lower grade men are replaced with relative ease, while the loss of a good man usually includes some specialized ability which is more difficult to replace. Little trouble should be experienced from placing a good man on a lower grade of work if the reason is clearly shown to him. In some instances his production will be enough greater to more than compensate for the difference in salary.

—T. J. MAUS, *Mechanical Engineer, Western Union Telegraph Company, Inc.*

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More Ways Than One

AS THE saying goes, "There are more ways than one to skin a cat." This holds true in cutting an Acme thread, as in everything else. There is always more than one way of doing a job; the secret of good foremanship, however, is to find out the one best way. That seems to be the trouble with Ed. He has not enough initiative to try other ways. This is proved by the fact that he allowed five out of six pieces to be spoiled by using one method. He is, therefore, responsible for the result, regardless of the fact that no better equipment seems to have been provided. Of course, if the foreman calls for better equipment and does not get it, he cannot be held responsible. On the other hand, it is the foreman who pays in worry and gray hairs.

—H. F. FIEDLER, *Foreman, New Era Manufacturing Company.*

Paying for Dependability

EVERY department has several men who go about their business in a quiet, efficient way, getting their work done without much fuss. They do not require constant watching from the boss, nor do they bother the other men. Generally, they are overlooked in the bustle caused by other men who do not work quietly, but the foreman knows that he can depend upon them to do what they should. Since they do not make a spectacular showing, their true worth is not always realized until some other concern recognizes their value and lures them away with higher wages. If a foreman had a large force of such men, much more of his time could be used for increasing the quality of the work. The foreman is a very busy man, and any industrious worker who can solve his own problems takes just that much less of the foreman's time, and consequently is worth more.

—L. O. BROWN, *Toolroom Foreman, Holcomb & Hoke Manufacturing Co.*

I THINK it necessary to distinguish between whether the good man is placed on an hourly rate or a weekly wage. In the latter case a bonus payment does not seem necessary, as the weekly status is a sufficient recognition of his worth.

A dependable worker on a weekly basis will produce more work without supervision, than the average worker will, stopping for frequent instructions.

The work of the ordinary man should always be inspected for quality, or else the good man may at times suffer by quantity comparison.

It is true that dependable men are slow to ask for a raise. I have such men in my shop, and I embrace every opportunity to increase their wages.

—FRANZ BERMANN, *Supt. Locomotive Plant, Austro-Hungarian State Railways.*

I BELIEVE in the worth of dependability, not only in the shop, but also in the engineering department and office. For instance, take the case of a machine designer or draftsman. I have known both speedy men and careful men. The latter may take half again as long as the speedy man, but it certainly pays. I have seen cases where a machine design had to be redrawn because of too much speed. When one takes into consideration the checker's time, the engineer's time, and the draftsman's time to redraw, speed is costly, and in the end it generally takes at least twice as long as the careful man would take to draw the same machine.

—W. F. ALLENBY.

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Compulsory Membership in the Mutual Aid

IN THE industrial countries of Europe there are in operation various and sundry schemes to provide financial and medical aid for workers, and to some extent for their dependents also, in case of accident or sickness. They vary from compulsory insurance under state or municipal control, to the purely voluntary mutual aid, giving only free medical treatment and a little financial assistance. It has been an almost universal experience that in the cases where assistance is needed most, the

discussion is not limited to foremen. Letters accepted and published will be paid for

father of the family has voluntarily made the least provision for meeting the need, either because he could not or would not. The tendency everywhere has been for the governmental unit, or the managements of large business concerns, to make such forms of insurance compulsory and continually to enlarge the scope of such schemes, both as regards the classes of employees insured and the benefits given. Once the principle is admitted there seems to be little opposition to its extension to cover almost all emergencies.

If mutual aid schemes are fair in themselves, and there is a large majority of employees in favor of them being compulsory, there is no good reason why they should not be made so. In making them compulsory, the management is not acting arbitrarily, but as the agent of the workers. No one notices either the dues or the compulsion after a few weeks.

—H. J. BURNHAM, *Birmingham, England.*

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What You Do, Or What You Get Done?

THE most efficient Machine shop foreman I have ever known used to walk 15 to 20 miles in the course of a day, all in his own department, and I believe if he could have used roller skates without danger to his neck he would have done a good 30. In addition, he carried nearly all his orders in his head. His office work, he did before the shop started and after it had stopped. Difficult problems he used to think about in bed. If a person cornered him in his office during working hours he was like a jack-in-the-box.

Then he had an illness, which kept him away for many weeks, and production in his department slumped badly. His men were used to his methods, and his assistants had never done other than assist. When he was well enough to return, the manager gave him a little fatherly advice. He was told to work from 10 till 4, take two hours for dinner and to spend half his time in the office. It was a difficult job, but he managed it. He had signal lights, operated from his desk, fitted up in the shop and called his sub-foremen into the office instead of running round after them. He had a chart made of the capacities of all the machines, and routed the work from his desk by using this and the blueprints, instead of looking at the job and at the machine. Instead of bothering his head with every simple query, he dealt only with those which the sub-foremen could not solve. That was several years ago: he now works full time and his department is a lot bigger and is efficient whether he is there or not.

—H. JAMES, *Birmingham, England.*

*

Learning from the Small Shop

IN GENERAL, special tools should go hand in hand with quantity production, and general purpose tools be used with small lots. Before using special tools on small lots, however, there are several things to be considered: Can the necessary accuracy be obtained without them? Does the date set for delivery to the customer allow time for the making of special tools? Is the cost of special tools offset by the time saved by their use? Is there any possibility of future orders for like parts? Could the special tools be used to advantage on any regular product?

The department doing the estimating should decide the methods to be used, but they will find it good policy to consult the foreman having charge of the section where the work is to be done. If he has a hand in determining the methods and routing there will be fewer mistakes. He is in a position to know the condition of his equipment, the extent of the small tools, and the individual skill of his men. He will also be more likely to see that the job is run exactly as scheduled and planned.

—F. L. INGLERIGHT, *Superintendent, Bradford Motor Works.*

* * * *

THE · NEXT · TOPIC

"When Personal Tools Are Damaged?"

The Ethics of Making a Change

SUMMARY OF THE DISCUSSION

Ed had an offer of another job that carried with it an increase of about twenty per cent. He preferred remaining where he was, but could not figure how to have both his present job and his prospective pay. So he went to Al for advice. Al told him that every man owed a certain amount of loyalty to the firm he was with, if they had treated him fairly. The question to be decided was what salary differential should be allowed for loyalty. Al took the stand that no man should change jobs for a raise of less than ten per cent of his salary and that the company he was with should be willing to advance anything over ten per cent.

A MAN is rarely justified in changing without the incentive of a wage increase, though other factors are important. It was admitted that a good foreman, by the nature of his affiliations with his company, must owe a certain amount of loyalty.

Satisfaction with a position means a lot, but it doesn't put the boy through college, or buy gas for the flivver. If an increase is in sight, it should be taken advantage of. It is a truism that grass always looks greenest on the other side of the fence, and sometimes the mere act of changing is attractive. Discontent is usually a result of irritation, not thwarted ambition as we sometimes believe.

Self-analysis of the present job, the prospective job, and the motives for making the change should precede any change. If the result seems to justify a change it will be foolish not to make it, because work without contentment is drudgery.

Usually a company pays no more for an executive than it is obliged to, and many men have made a change to their ultimate sorrow.

Rolled zinc, pressed and plated with nickel or chromium, is now used for automobile running board binding

Uncommon Properties of a Common Metal

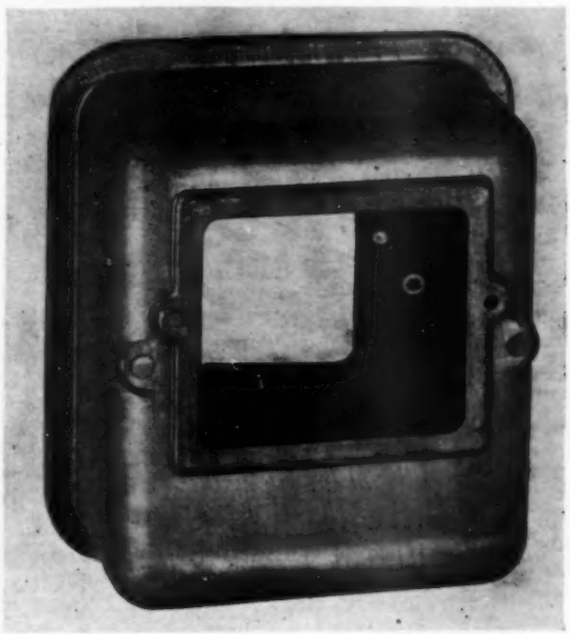
By Robert M. Curts
Technical Service
The New Jersey Zinc Company

Rolled Zinc may be fabricated much as other metals, more readily than some. It is well adapted for plating

ZINC. It served well under the old airtight stove. It kept the water that dripped from the leaky icebox off the floor. It saved the kitchen table from the bread knife. And now that the "airtight" has grown up into the oil burner, the icebox into the electric or gas refrigerator, and the kitchen table boasts a new enameled top, zinc also has evolved into new services.

Manufacturers seeking a metal that resists corrosion, that forms easily and finishes attractively, and that is still economical, have found many uses for this once humble metal. And recent investigations have discovered much information on the best methods of fabricating and finishing it. Relatively simple technique has been established for the application of durable and attractive electroplating finishes in nickel, chromium, brass, silver, and other commonly used metals. Rolled zinc comes in several grades, having varied physical properties, supplied according to the purpose to be served.

With a few exceptions, the fabrication of rolled zinc is quite similar to that of other commonly used ferrous and nonferrous metals. In many cases zinc is replacing other metals without necessitating the change of a die, or of the working technique. Like any other metal, however, zinc does have certain individual physical characteristics which make it necessary to observe slightly different procedures in some instances. This is particularly true in drawing operations. The technique used on zinc requires a knowledge of the difference between the mechanical properties of this metal and those of brass, bronze, steel, and other rolled metals, but imposes no additional hardship on the fabricator.



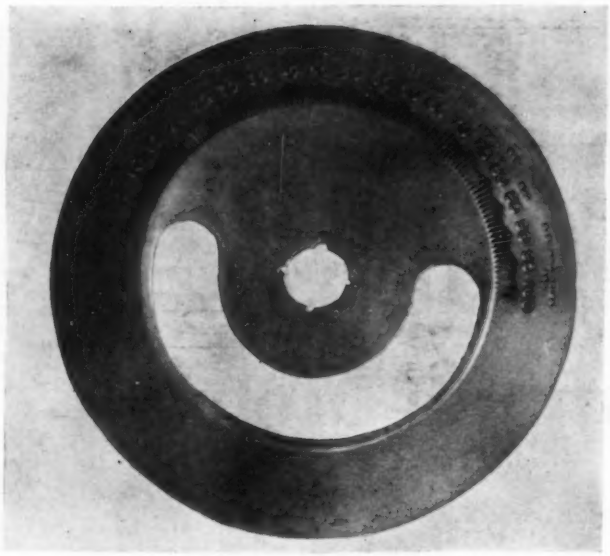
Though a slightly different technique is sometimes necessary, zinc is easily drawn

Rolled zinc works best at a temperature of 70 deg. F., or slightly higher. The working qualities fall off rather rapidly as the temperature drops below 70 degrees. Metal kept in unheated places during the winter months should be allowed to attain normal room temperature before it is subjected to any severe forming. Preheating the metal to any degree does not improve its working qualities, but is quite sure to affect it adversely by causing excessive grain growth. Slight warming, up to 100 deg. F., often makes possible an operation which is not successfully performed at room temperature.

In all operations where a lubricant is required, soapy water is usually the cheapest, and is quite satisfactory. Not only is it suitable, but sometimes necessary, for it is really a better lubricant for zinc than most of those used for brass, steel, and other metals. A neutral soap will prevent staining. If the article is not to be finished by plating, lacquering, enameling, or buffing, it should be quickly dried in sawdust or by some other suitable means.

In designing dies for successive drawing operations on rolled zinc, the following directions are recommended:

1. Compute the total area of the finished cup and allow for a trim of $\frac{1}{4}$ inch.
2. Calculate the diameter of the circle of a blank having the above area.
3. The reduction in diameter from the blank to the first cup should



Stamping and embossing are readily accomplished on rolled zinc

not exceed 40 per cent of the diameter of the blank. If the cup has a flange, this must be included in the diameter. It will be noted, in this respect, zinc differs somewhat from brass, steel, and some of the other rolled metals in that the first operation is of necessity somewhat less severe. But such a limitation is usually not so vital to the economy of zinc as it might at first seem, because it is usually compensated for in the operations which follow. A readjustment of the amount of work done in the second, third, and subsequent stages usually will make the total number of operations the same for zinc as for other metals.

4. The reduction in diameter of succeeding cups should not exceed 20 per cent of each preceding cup.
5. Die clearances should be equal to twice the thickness of the rolled metal plus 0.001 to 0.0015 inch, according to the complexity of the die.
6. Fillets should be generous. Frequently a die which has been designed for another metal will not work with zinc because the metal must flow over extremely sharp edges. A slight change in the radii of these edges will usually overcome this difficulty without objections. Zinc is "self annealing" at ordinary room temperature, which eliminates the necessity of annealing between drawing operations and makes it suitable for use in an automatic press of the so-called progressive type.

Rolled zinc solders easily, although some care should be taken to prevent unnecessary overheating, which might cause grain growth and loss in strength. Half-and-half solder is generally used. A solder composed of 55 per cent lead, 30 per cent tin, and 15 per cent cadmium is sometimes employed where special results are desired. Acidulated zinc chloride (cut hydrochloric, or "muriatic," acid) serves satisfactorily as a fluxing material.

Attractive finishes on articles of rolled zinc base are obtained by the use of colored lacquers and enamels, or by chemical or electrochemical plating. Electrodepositions on nickel, chromium, silver, copper, and other metals gives fine finishes.

Zinc buffs easily and affords a good surface for plating. Ordinary buffing equipment employed for aluminum, brass, and steel is suitable also for zinc. A free-cutting tripoli with a loose-stitch cloth wheel is ideal. Abnormal pressure on the object being buffed should be avoided, lest it result in "dragging," "warping," or "waviness."

A simple solution of trisodium phosphate (6 oz. to a gallon of water, or 45 grains per liter) is an effective electrocleaner. The use of strong alkalies or cyanides usually causes unsatisfactory surface conditions. The article to be cleaned serves as the cathode, and sufficient current is applied to cause gassing. Usually ½ to 3 min. will cleanse thoroughly.

The radiator cap above is an example of how zinc lends itself to drawing and knurling

Many attractive finishes are possible with rolled zinc as a base

Alternate rinsing in hot and cold water should follow cleaning, and after that, a brief immersion in a 1 per cent solution of hydrofluoric acid. A 5 to 10 per cent hydrochloric acid solution is sometimes substituted, but has a slight tendency to discolor the zinc. The lightly etched surface resulting from the dip in hydrofluoric acid solution makes the plating adhere better.

Other metals may be plated directly on zinc, but the use of nickel as a primary coat is advisable. When copper, brass, and other metals must be deposited directly on zinc from cyanide solutions, very careful control is required to avoid blistering. Several of these metals may also be slowly absorbed by the zinc unless separated by the nickel coat.

In plating zinc with nickel, the following sulphate bath has proven suitable:

Single nickel salts.....	10 oz./gal.	(75 gms./1.)
Anhydrous sodium sulphate..	15 oz./gal.	(113 gms./1.)
Ammonium chloride	1.75 oz./gal.	(13 gms./1.)
Boric acid	2 oz./gal.	(15 gms./1.)

Variations in the sodium sulphate content of the bath are governed by the size and shape of the articles being plated. For flat objects, the sulphate concentration may be reduced to 8 or 10 oz. per gallon, while for more complicated shapes, streaking occurs in the recessed areas unless the concentration is higher.

The sulphate bath performs satisfactorily with zinc at room temperature with a current density of 12 to 18 amperes per sq.ft. It is advisable to increase the initial current density to 30 amperes per sq.ft. for the first few

minutes. This minimizes the possibility of streaking. The acidity of the bath should be maintained at Ph between 5.8 and 6.2 by additions of ammonium hydroxide or sulphuric acid. Agitation of the articles being plated tends to reduce porosity and permits the use of higher current densities. With certain shapes, agitation is absolutely necessary.

Experience shows that nickel coatings over any base metal should be at least 0.0003 in. thick to be really serviceable. Thinner coatings will not give satisfactory life in outdoor exposure. After the first coating, subsequent coatings of nickel on the zinc base are applied as on any other base metal. With chromium, a current density of 75 to 150 amperes per sq.ft. gives satisfactory results over 0.0003 in. of nickel.

Chromium, recent investigations have shown, may be plated directly on the zinc base with fair results. When applied from the chromic acid bath, chromium produces a dull, "frosted" surface which requires considerable buffing and coloring. One must be careful not to buff through the chromium. But, where the "frosted" finish is desirable, the direct application of chromium on zinc does well.

Silver, copper, gold, brass, bronze, and other plated finishes are readily applied over the initial coat of nickel, and they may be oxidized or otherwise treated.

As a base material, zinc lends itself well to plating operations. It affords a white, rustless background especially suitable for nickel and chromium-plated articles which are to be subjected to hard wear and outdoor exposure. If constant polishing of the coating should result in exposure of the base metal, the zinc will not corrode rapidly, nor will it offer severe color contrast with the plating which remains. The uneducated eye can scarcely detect where the chromium, or nickel, and the zinc merge after polishing.

Easy to form, rustless in nature, easy to buff and polish, and simple to plate, zinc offers a suitable base material for many parts now being plated of other metals. It is being used considerably in the automobile industry where it has been found economical, and other industries are exploring its possibilities.

Important Developments in the Gray-Iron Industry

By ARTHUR J. TUSCANY

Manager, Gray Iron Institute, Incorporated

FROM an engineering standpoint, quantity production is made possible, first by so subdividing operations that each step is made as simple as possible, second by providing machines wherever possible to take the place of hand labor, and finally by devising a system of control and inspection which will insure the work being turned out to predetermined standards. Of these three steps, the latter is perhaps the most important, but the first two have resulted in a complete change in the way the factor of human skill enters into the problem of production.

It is customary for those who take the position that modern high-speed production implies a lowering of quality to point out that these methods have eliminated the skilled workman and annihilated craftsmanship, without which a superior product cannot be produced. This is not true. What quantity production has done is to change the way in which craftsmanship is applied to the job. In part, under the factory system, the responsibility for quality, which is the most that craftsmanship implies, is transferred to the engineer and the trained executive, while the workman instead of losing by this shift, is left free to specialize and to become truly skilled within his particular sphere.

In the foundry, special methods involving radical departures from regular, traditional, or what might be termed orthodox practices, have had to be developed and introduced. Commenting on this, Pat Dwyer, engineering editor of *Foundry*, has said: "It was realized that the human factor could not be dispensed with altogether, but it was felt that by providing suitable mechanical equipment, the output from each operator could be tremendously increased without the slightest deterioration in quality. Furthermore, as the scope of mechanical equipment was extended, it was found that the process of making molds could be divided into many elements and that each of these elementary operations could be performed by a separate workman. Therefore, where formerly a period of four years was required to develop a molder, competent to begin and finish his work, under the system now in vogue in specialty shops, ordinary laborers can be taught in a few hours to fill any missing link in the long chain of production."

This not only illustrates the flexibility of the quantity production system, but also goes to show that while molding skill, manual dexterity, and mature judgment on the part of the workman are regarded as an important requirement in a jobbing shop, they are neither an asset nor a necessity in a specialty foundry. Power-driven devices, accurate pattern and flask equipment, and mechanical appliances for handling materials and making molds have reduced the personal element to a minimum and have placed the manufacture of certain classes of castings on a mechanically automatic basis. And in many cases, as has been demonstrated, the superior precision of the machine actually has resulted in both a more uniform and a better product than could possibly be produced by the most skilled molders working under traditional conditions.

But the necessity for a comprehensive and intimate knowledge of foundry practice is by no means eliminated under the quantity production system. It is simply transferred from the many to the few. On those who remain the repositories of skill, judgment, and knowledge, the burden of responsibility is enormously increased. It

An abstract of a paper presented at the annual meeting of the American Ceramic Society and the American Refractories Institute, on Feb. 19 at Toronto, Canada.

is the part of these leaders to synchronize and co-ordinate the efforts of the various operators, and to set high standards and see that they are maintained. But in a large shop a few such men can direct, vitalize, and control a thousand workmen. Under this system, the individual workman simply does one part of a job over and over again. Logically, he does it as well if not better than a man who has to spread himself over many jobs. Under the quantity production system, each operation is performed by an expert who soon develops far more skill than the best journeyman molder who tries to do everything. This tends strongly to an improvement in the quality of the product rather than the reverse.

Material Handling

Material handling presents a sizable problem in every foundry. On account of the quantity of material which must be moved, real opportunities for savings and employment of engineering skill are offered. For instance, at the Buick foundry it was found that it was necessary to handle over 64 tons of material for every ton of finished castings produced, in spite of the fact that the plant is laid out so that a continuous flow of materials is possible. In another foundry, one crane operator and one laborer are unloading 40 tons of pig iron with a magnet in an average time of 45 minutes. This estimate takes into consideration transferring the metal a distance of 50 ft. To do the same work by hand would require at least 15 men.

Foundries catering to the machine tool trade must meet closely drawn specifications and at the same time get out a large tonnage. In a foundry taken over by the Bullard Machine Tool Company, Bridgeport, Conn., the average daily output of castings per man was raised from 350 pounds to 1,180 pounds through the application of intensive production methods coupled with a plan of paying wages which provides a bonus in addition.

Quality standards cannot be maintained under any system of quantity production which does not provide good wages. In fact, in the most successful quantity production shops, where the highest grades of work are turned out, the men earn considerably more than they could obtain for similar work in most other shops. But since these high earnings are spread over an increased output, the wages per ton are usually less than the average.

At the Bullard foundry, the average output recently has not fallen under 1,020 pounds of good castings per man per day, with a maximum in one week of 1,360 pounds per day. This is on lathe beds, head stocks, and other machine tool castings. Tests have shown that owing to the use of proper equipment and careful supervision this rate of production has not brought about any deterioration in the quality of the castings.

Chemical control of melting practice, coupled with patient research into metallurgical mysteries, are almost invariably found in foundries of the better sort. This continuous analytical control makes it possible to detect immediately any tendency to diverge from the predetermined standards of quality, these divergencies being corrected before they have become serious.

Nor is the scientific control of the metal, right in the foundry, confined to chemical analysis. For instance, pyrometers are being used to determine the temperature of the molten iron at the cupola, in ladles of various sizes, and at various locations in the foundry, with the result that by rearranging the location of the light and heavy casting floors, altering the sizes of the ladles, and the number of transfers of metal, the quality of the product is being vastly improved.

It is not difficult for foundries to produce gray iron to which no steel has been added, under the conditions of chemical control suggested here, with an average tensile strength of over 36,000 lb. per sq.in. Almost any iron foundry metallurgist in the United States, in the better class of shops, has seen many hundreds of heats of iron of 36,000 to 38,000 lb. per sq.in. tensile strength. These irons are of course formulated to fulfill particular conditions and should not be compared seriously with the product of many jobbing foundries catering to trades in which quality is not a desideratum.

It has been possible to put the large-scale foundry operations on an exact basis largely through the fact that pig iron is sold exclusively by analysis. Few, if any foundries purchase pig iron by fracture. Instead, the blast furnace furnishes a report showing the analysis of each carload of iron delivered. These analyses are sufficiently accurate so that the smaller foundries can use them for calculating their mixtures.

Steel Alloys

Mixtures containing a quantity of steel and about 1 per cent nickel have given tensile strengths averaging over 58,000 lb. per sq.in., according to R. S. MacPherran, chief chemist, Allis-Chalmers Manufacturing Company. Other alloys employed in addition to nickel are chromium, vanadium, and molybdenum. Chromium by retaining the carbon in the carbide form enables the foundryman to produce an extremely hard iron which resists abrasion and heat; however, its effect generally is modified by the addition of nickel which tends to precipitate graphite in a more finely divided state than silicon.

Molybdenum improves the strength, density, and wearing properties of gray iron with additions around 0.35 per cent. Vanadium increases the tensile, transverse, and compressive strengths of gray iron. However, castings containing the alloys mentioned demand a higher price than the ordinary gray irons, and unless required to meet a specific purpose, they should not be specified. Too many times a casting buyer will demand an alloy casting when the ordinary type will meet his requirements, or he will specify the amount of alloy to be incorporated without knowing its exact effect.

Scientific melting has done much to improve the melting poured into castings. In the better foundries this operation is no longer rule of thumb. The foundryman knows the best weight for the iron charge for his particular cupola, the amount of coke necessary to melt the iron rapidly and hot, and the amount of air that should be supplied to burn the coke properly. Consequently, some of the former difficulties of too cold iron, blowholes, shrinks, and similar troubles in castings have been eliminated to a great extent.

A number of foundries are producing high-grade iron castings from iron melted in the electric furnace. Due to the flexibility of this method of melting, the iron can be refined similarly to steel. However, the carbon, manganese, and silicon only are reduced to a point desired for the type of iron being melted. Castings produced by this method of melting bring a relatively higher price on the market, but are said to possess higher strength than for the same analysis produced in the cupola; have a more uniform structure, and the metal is denser.

Overcoming the Smoking Habit in Oil-Fired Furnaces

By F. J. GUTSCH
Foreman, El Paso Blacksmith Shop, Southern Pacific Company

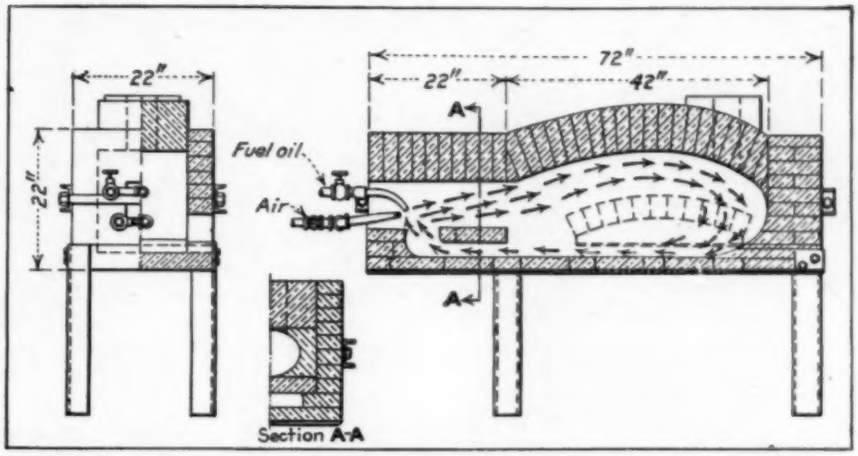


Fig. 1—Constructional diagram of an oil-fired furnace having a preheating chamber in which the fuel is thoroughly atomized before it enters the combustion chamber. The furnace heats up quickly and meanwhile gives off no smoke

TWO major difficulties experienced in the operation of oil-fired furnaces, such as are used in railroad shops and others, are inability to heat the combustion chamber rapidly, and inability to prevent an excessive amount of smoke while the heating is taking place. Overcoming these difficulties goes a long way toward making the operation of such furnaces more satisfactory.

Fig. 2—One of the furnaces used for heating light work to temperatures ranging from 1,300 to 1,700 deg. F. The arrangement of the burner is such that the oil is thoroughly ignited before it enters the combustion chamber, thus eliminating smoke

After experimenting with various types of heating chambers, the El Paso shops of the Southern Pacific Company have developed an oil-fired furnace in which the greater part of the above-named objections have been eliminated. A layout of one of these furnaces is given in Fig. 1, showing an outline of the combustion chamber and the arrangement of the burner. At the left of the combustion chamber there is a preheating chamber, 22 in. in length, varying from a round opening of 6 in. in diameter at the entrance, to an elliptical opening 7 in. high and 10 in. wide at the mouth of the combustion chamber.

The compressed-air pipe, ½ in. in diameter, is flattened at the end and extends 3 in. into the preheating chamber, slightly below the center. The oil line is also ½ in. in diameter and is reduced to ¼ in. at the delivery end. It projects some 4 in. into the preheating chamber directly in front of the air line and ¼ in. above it. To light the furnace, the air valve is opened slightly, a piece of burning waste is placed through an opening at the left, and the oil valve opened slightly. The air forces a spray of oil into the chamber, where it ignites. The flame follows the contour of the top arch of the furnace to the right-hand end, from whence it passes back along the bottom of the furnace and enters a sub-preheating chamber, returning to the preheating chamber at a point just ahead of the oil feed. The passage of the flame is indicated by arrows.

The sub-preheating chamber is located under the preheating chamber, and tapers from 3x10 in. at the combustion-chamber end to 3x4 in., with an opening that directs the flame into the preheating chamber. The burner has been found economical, since it burns almost every particle of the oil, leaving no carbon deposit where the flame reaches the end of the furnace. It heats the chamber quickly; in fact it is possible to begin heating

work within ten minutes after the oil has been ignited.

In operation, the oil drops on to the sharp blast of air, which breaks it up into small particles. As the subpreheating chamber heats up, the heat thoroughly vaporizes the oil, resulting in almost perfect combustion as it passes through the opening into the combustion chamber. After the furnace has been warmed up, no smoke whatever is given out. Summing up the general results, the improved method of combustion has proved efficient and economical, and the shop is never clouded with oil smoke.

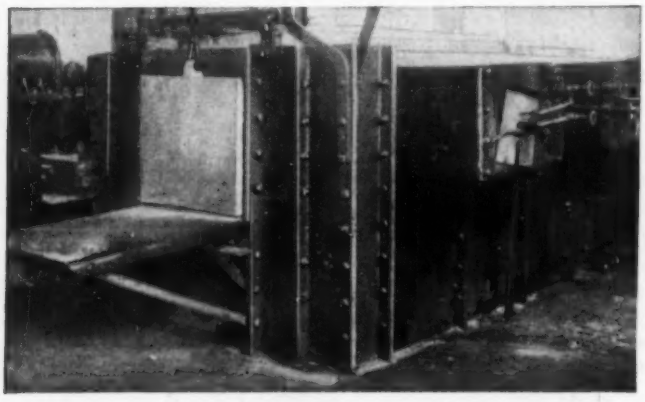


Fig. 3—An oil-fired furnace having two burners and two combustion chambers. The flame is directed around the contour of the furnace and back along the bottom to the preheating chambers, thus aiding in keeping the oil thoroughly ignited

One of the furnaces of this type is illustrated in Fig. 2. It is used for heating light work to temperatures ranging from 1,300 to 1,700 deg. F. A larger furnace equipped with two preheating chambers and two burners is shown in Fig. 3. The general construction of the chamber is somewhat similar to that described for the

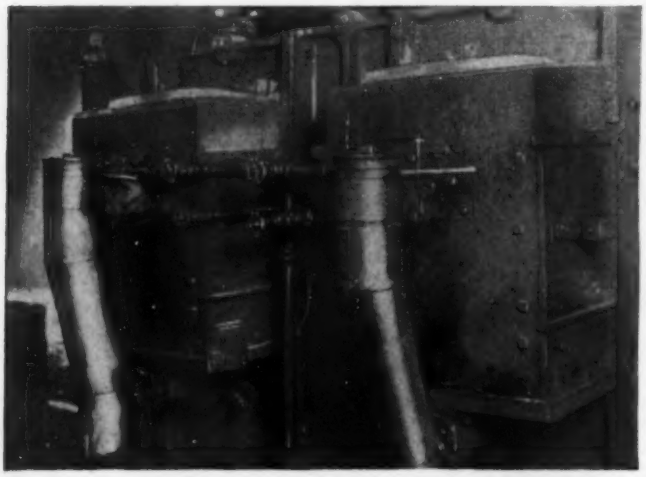


Fig. 4—A close-up view of the preheating chambers in the furnace shown in the previous illustration. The burners are so arranged that the ignited oil is forced into the heating chamber

single-burner furnace. A close-up view of the preheating chambers is shown in Fig. 4. The furnace is used for heating rods, drawbars and work of fairly large size. The burners maintain a uniform heat. Other advantages are a saving in fuel, since there is no flame directly against the metal being heated. Almost any kind of fuel oil can be used, and bars up to 1¼ in. round can be heated in seven minutes from a cold start.

· BOOK · REVIEWS ·

ROBERT HENRY THURSTON. *By William Fredrick Durant, professor (emeritus) of mechanical engineering, Stanford University. 301 pages, 6x9 in. Illustrated. Bound in cloth boards. Published by The American Society of Mechanical Engineers, 29 W. 39th St., New York. Price $4.*

TO GRADUATES of Cornell and Stevens, Prof. or Dr. Thurston, as he was known, was a very real, much respected, and truly loved personality. To most other engineers, perhaps, he is now little more than a name. Dr. Durand's biography of the man who did so much of the pioneering in engineering education will refresh the memories of the former, and will afford the latter a beautifully written story of the life of a great man.

It is particularly appropriate that this life of Dr. Thurston, first president of the American Society of Mechanical Engineers, should appear just as that body is completing plans for the celebration of its 50th anniversary. Dr. Thurston served as president of the society for two and one-half years and contributed something to every volume of its transactions up to his death.

Dr. Thurston contributed but few articles to the early numbers of *American Machinist*, but his total of books, articles, speeches, and letters is simply amazing when one takes into account the many other activities that engaged his time. An appendix containing the titles of his published works occupies more than 40 pages of Dr. Durand's book.

In some of his earliest addresses Dr. Thurston voiced his belief that politics needed the orderly mind of the trained engineer, and that it was his duty to take an active part in civic affairs. How pleased he would have been could he have lived to see the extent to which engineers are now active in politics and statecraft!

Dr. Durand's book, a labor of love, is truly inspirational and well worth the short time it takes to read it. The Society is to be congratulated on its latest venture in the biographies of its outstanding members.

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MECHANICAL TIGHTENING. *By L. E. Noble and J. A. Roenick. Sixty-three pages, 8x11 in. Cardboard covers. Indexed. Published by the McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York City. Price $1.*

ONE of the maintenance series of instruction manuals for automobile mechanics, this flexibly bound book may also prove of advantage to mechanics and machinists in other branches of the field. Although a large portion of the material is devoted specifically to automobile repair jobs, there is a considerable amount of supplementary material on methods of fastening parts, tightening, removing play, sharpening drills, lubricating, proper use of wrenches, job analysis, safety in hoisting, forms and records, locating parts in a drawing, and proper use of screwdrivers. The book is plentifully illustrated and contains references to a number of texts for reference and correlative reading. It is a working manual, written in a workingman's style.

IDEAS *FROM PRACTICAL MEN*

The department, "IDEAS FROM PRACTICAL MEN," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

Concavities and Convexities

A Symposium on Concave, Convex, and Oval Machining

In three sections. The last will appear next week.

THE PRECEDING article of this symposium described numerous methods of generating concave and convex surfaces in a lathe by means of simple attachments that, in most cases, could be easily detached. This feature of easy detachment is important, as the average shop cannot afford to tie up a lathe for an infrequent operation.

The same is true of a boring mill, only more so. A boring mill is not a single operation machine, and when a concave or convex shape is turned, other operations on the same piece must be performed in their sequence. The examples shown demonstrate how this can be done.

While the rigging for a boring mill is more complicated, it may be that the ease of chucking, and the fact that other sequential operations can be performed, compensate for the complication.

By FRANZ BERMANN
Superintendent of Locomotive Plant
Austro-Hungarian State Railways

IN MAKING major repairs on steam locomotives of the Mallet type, it was found necessary to machine the ball joints for the articulated exhaust steam line. For this purpose we designed and built the various devices shown in the illustrations, and they have operated successfully.

In each case the device is mounted on a 36 in. Bullard boring mill, and it will be noticed that the devices are clamped in the vertical turret, similar to ordinary tool practice. They remain in their place while other stations are brought into working position. This removes the machine from the single purpose category that is their usual state when using spherical turning devices.

The rigidity and accuracy of the device for convex turning may be judged from the following data:

Material	Hard bronze
Diameter of sphere	12 in.
Height of spherical segment	5.5 in.
Speed	72 r.p.m.
Feed, roughing	0.033 in.
Feed, finishing	0.018 in.
Cutting tool	high speed steel

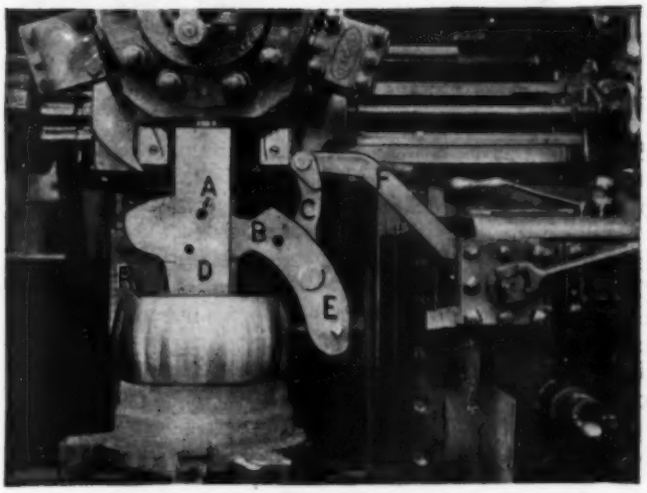


Fig. 1—Device fitted to a Bullard vertical turret lathe. By disconnecting C and E and inserting a bolt in A and B the fixture may be revolved with the turret

The finished surface showed no chatter marks, indeed, as the illustration shows, it has the appearance of a polished surface. Although a line appears at the center, the whole segment was machined in one cut.

The best results are secured when the straight part of the curved tool holder *E*, Fig. 1, fits snugly between the two parts of the perpendicular member of the holder *D*. If there is no cramping at this point, the rods *C* and *F* are perfectly free from side pressure and transmit the feed accurately. These two rods appear weak, but it must be remembered that the cutting pressure is borne entirely by the members *D* and *E*.

It is of course important that the surfaces of the different parts, the rods *C* and *F* included, lie in the same plane so that there will be no unnecessary binding during their relative movements. Likewise, the axis of each hole in the different parts must be perpendicular to that plane. If these two conditions are observed, the different members will function smoothly and continuously.

Fig. 2 shows the rigging used for machining the concave face of the mating part. The finish obtained is equally as smooth as that of the convex surface.

In this arrangement the cutting bar is pivoted to the holder extending down from the turret and is fed up or

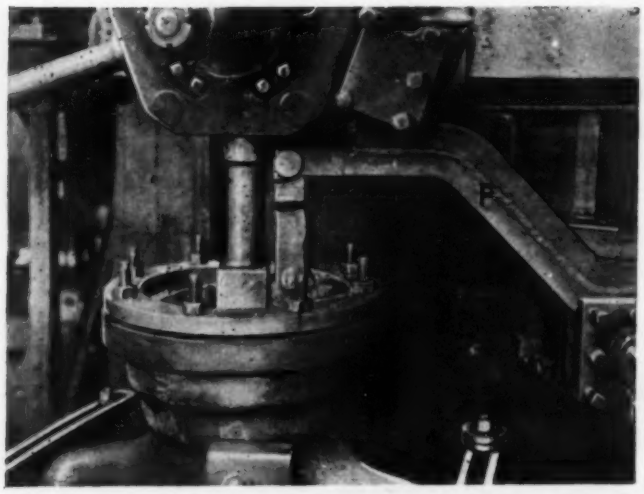


Fig. 2—Fixture for the mating part of the ball shown above. The fulcrum of the cutting bar is central with the axis of the table and is fed up or down by the side head

down by the side head. It was found necessary to strengthen the member *F* in order to eliminate the chatter caused by the weakness of the original member.

Still another device, for turning a concave valve cap, is shown in Fig. 3; the material was white metal and the two necessary cuts were taken in 14 minutes. The finished surface was mirror like. The main holder, used in the turret, is the same one that was shown in Fig. 1. The turret remains stationary and the movement of the tool is secured through the side-head feed.

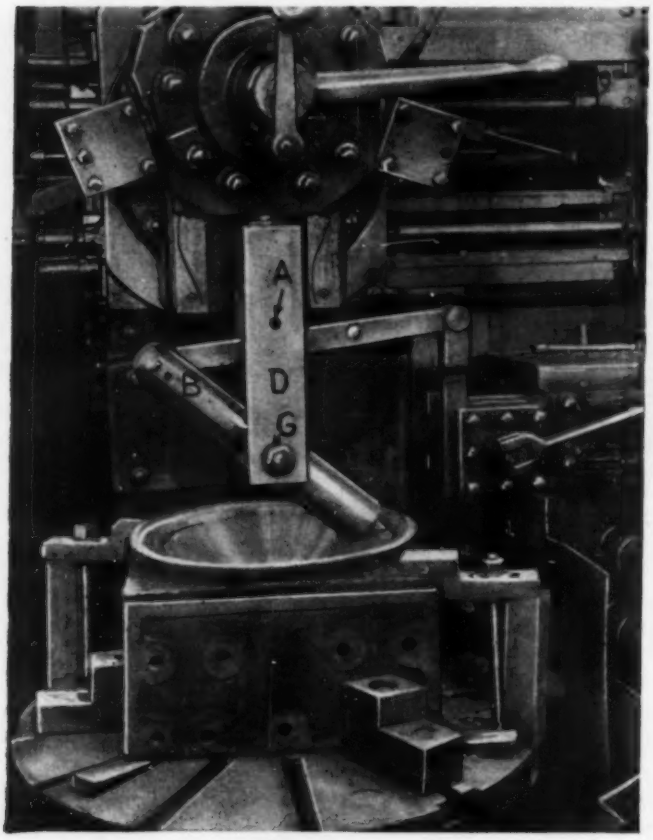


Fig. 3—The set up used to concave valve covers. This tool will also revolve with the turret, when C is disconnected and E fastened in an upright position

In all applications it is of course necessary to adjust the device so that the fulcrum of the cutter bar is at the center line of the surface to be turned.

This is comparatively simple where the fulcrum in the cutter bar is central with the extension bar in the turret because the Bullard mill has a stop to bring the turret central for drilling operations.

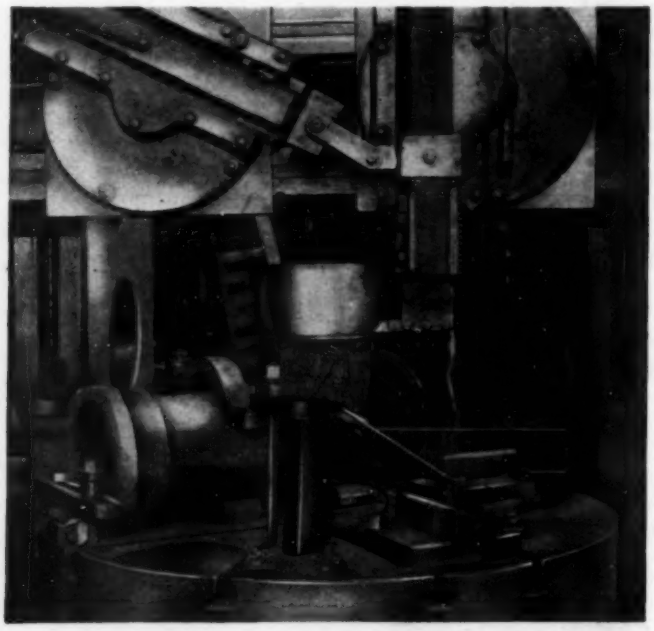
In adjusting for vertical height, a finished surface from which to measure is usually available.

It was stated that the devices did not prevent other operations being done on the machine, each in its proper sequence. This is shown clearly in Figs. 1 and 3, where the hole *A* in the main holder coincides with hole *B* when the device is not in operation. With a bolt holding the cutter bar, the turret can be revolved in the usual manner, without removing the device.

By Max Schwarze

Foreman, Milwaukee Shops, C. M. St. P. & P. Railroad

THE accompanying photograph shows one of several possible methods of turning a ball surface on the end of an elbow-type casting. The arrangement is almost self-explanatory. Certain features should be pointed out, however. In the first place, it is necessary to disengage the horizontal feed screw so that the entire right-hand head can slide freely on the cross-rail of the boring machine. The left head is firmly secured to the



Machining an elbow fitting for a locomotive steam line. The cut is continuous

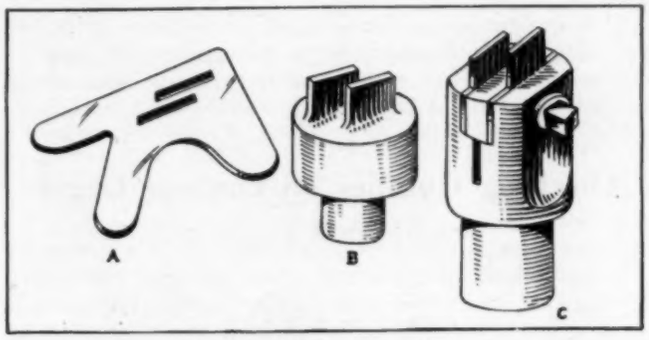
rail to avoid shifting the axis of the short link that connects the two heads. This link must be of the same radius as the ball being turned, and its fixed center must be exactly in line with the center of the ball below it. Since it is necessary to take several cuts on the ball to finish it, the tool must be shifted for each cut.

In setting up the machine, the short connecting link should be in a horizontal position and the ram of the right-hand head should be fed downward until the tool, which is a pointed one, is exactly on the horizontal center line of the ball. This point should be marked on the ball before it is placed on the table. The ram may then be withdrawn and the cut started.

Tool Economy

By Charles H. Willey
Asst. Plant Supt., Hoyt Electrical Works

We had to make a large quantity of pieces from $\frac{1}{32}$-in. soft brass, such as the one shown at *A*, and had considerable trouble caused by breaking the punch for piercing the slots. The punch, shown at *B*, was made from the



Solid and built-up punches

solid, and though hardened and drawn in the most careful manner, it would not stand the gaff.

One of our toolmakers hit on the idea of making the punch by inserting two pieces of an annealed blade from a power hacksaw in a holder, as shown at *C*. This punch stood up excellently, piercing the slots in 25,000 pieces without breaking or having to be ground. When it finally broke, it was a simple matter to renew the parts.

Press Tools for Trimming Screw Heads

By Charles H. Willey
Asst. Plant Supt., Hoyt Electrical Works

It was necessary to trim off one side of the heads of a large quantity of small brass screws, so that they could not turn, as indicated at *A* in Fig. 1, the screws being tightened on the work by nuts from below.

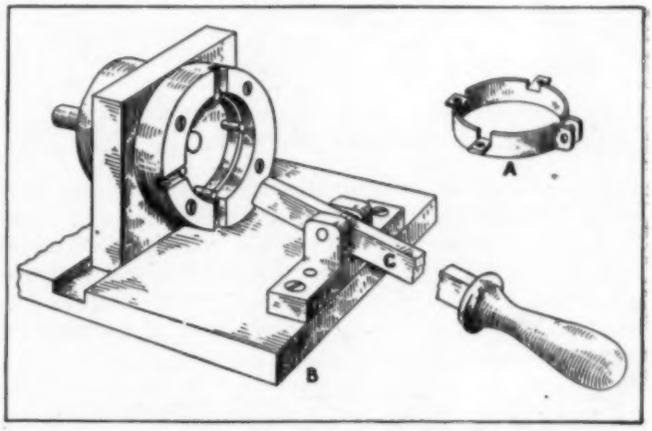
The toolroom foreman had one of his men make the press tools shown in Fig. 1, holding four screws. After using these tools for trimming the heads of a few thousand screws, they were condemned for the following reasons: first, it took too long to place and remove the screws, and second, the heads were flattened considerably by the pressure of the punch on them while forcing down the holding section against the resistance of the pressure plate.

At the suggestion of one of the toolmakers, the tools shown in Fig. 2 were made. The die was slotted to admit the bodies of the screws, the heads resting on top above the slot. Since there was some skepticism as to the thin edge *A* of the lower shear member holding up, the whole die was drawn pretty well. In setting up the tools, adjustment was made so that the punch was brought just low enough to shear the small pieces from the screw heads. These tools sheared the heads of 20,000 screws at a cost of 4 cents per hundred.

A Temporary Tool for Notching and Bending

By Charles H. Willey
Asst. Plant Supt., Hoyt Electrical Works

Recently, we made 1,500 meters of a special type for a customer. One of his requirements was that each meter be furnished with a clamping band, such as shown at *A*, having three lugs and two ears. The lugs were for attaching the meter to a support by means of screws, and the ears were for the clamping screw.



Tool for forming lugs on clamping bands

The problem of making the clamping bands cheaply and without expensive tools was gotten around by the temporary tool shown at *B*. The bands were cut in a lathe from $2\frac{1}{4}$-in. semi-hard brass tubing. They were $\frac{5}{16}$ in. wide and $\frac{1}{32}$ in. thick. The notches were cut and the lugs were formed before splitting the bands and bending the ears.

A band was placed in the fixture and the first notch was cut, the lug being bent into the lower slot in the fixture by the inner end of lever *C*, the slotted ring acting as a cutting and bending die. The band was then ejected by a pin connected with the hand ejector at the back of

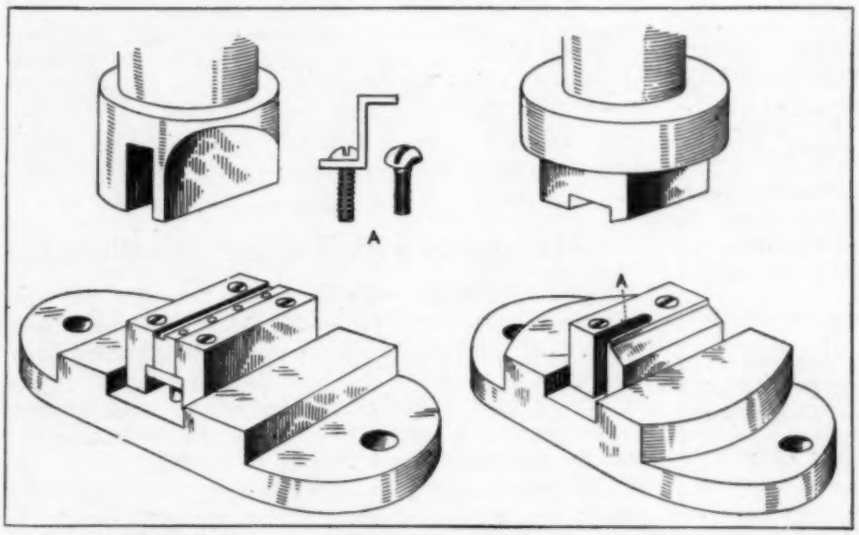


Fig. 1—The tools that were condemned. Fig. 2—The second and successful set of tools

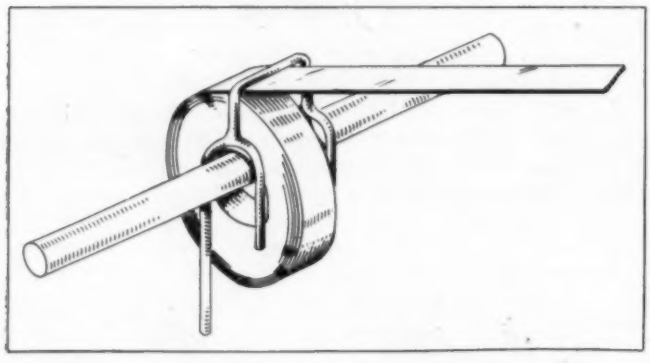
the fixture. It was rotated 90 deg. and put back into the fixture, the lug just formed entering the slot at the side, thus indexing for the next cutting and bending. This operation was repeated until all the lugs were formed, after which the band was split, the ears bent and the holes drilled.

While this tool may appear to be clumsy and slow in operation, it really did a good job at a fair speed, notching and bending the lugs in 150 bands per hour.

A Holder or Guide for Roll Stock on a Punch Press

By Henry C. Francis

Here is a device I saw the other day in a small shop, for use with a coil or roll of flat punching stock as it is fed to the punch press. The coil was mounted on a bar held between two horses or frames in the usual way, but



A hairpin for roll stock

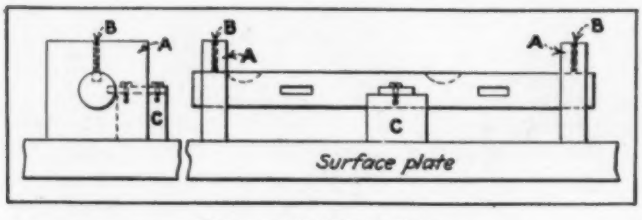
the sort of double hairpin arrangement, of which only one side is shown, was placed over the coil as in the illustration. It serves to keep the roll from running wild and was a part of the equipment of each punch press with a roll feed. It puts a slight tension on the coil and holds it in line. The long end of the hairpin keeps the device vertical.

Fixture for Checking Keyways

By Charles Kugler
General Electric Company, Philadelphia

This method of checking keyways for Woodruff keys in 6-ft. shafts, set at an angle of 90 deg., proved to be both fast and accurate.

Two blocks of steel *A* were bored to fit the shafts and were milled square by the use of the dividing head. Holes were drilled and tapped for the holding screws *B*. The whole assembly was placed on a surface plate, as shown. The block *C*, having a piece of flat steel of the proper thickness fastened to the top by screws, constituted the gage. The center of the piece of flat steel was, of course, at the same height as that of the shafts. With the end blocks in place on a shaft, the shaft was rotated until the gage could be entered in one of the keyways, and the holding screws were then tightened.



Keyway checking fixture

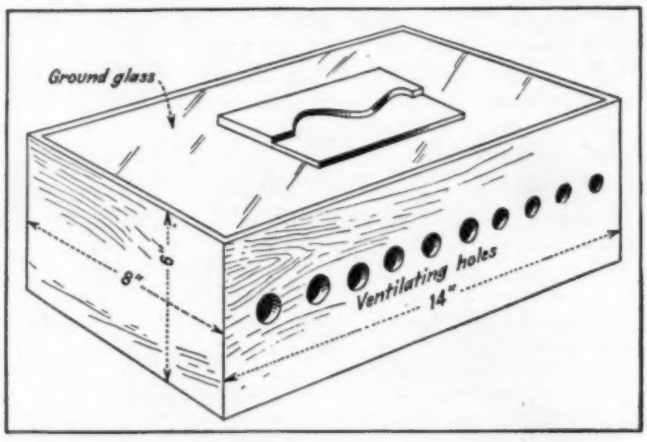
After checking the keyways on one side of the shaft, the whole assembly was rotated 90 deg., bringing the keyways that were on top to one side. In this position those keyways were checked.

It is evident that a fixture built on the same principle can be used for keyways set at any angle. Of course, the end blocks would have to be milled to the same angle as that between the keyways.

Checking Outlines on Contour Gages

By Chester H. Franklin

I saw a clever device in a toolroom the other day where a toolmaker was at work on contour gages. He sat on a stool at a bench of convenient height, and beside him at about the height of his elbow, was a box-like arrangement with ground glass on the upper side. The box was about 8 by 14 inches on the upper side.



Illuminated glass plate for checking gages

Inside the box was an electric lamp of a wattage that illuminated the ground glass, without any glare in the eyes of the toolmaker. By laying the gage being made and the templet flat on the ground glass, any discrepancy between the two contours was shown at once.

Similar devices are used in inspecting certain products but the use in the way mentioned is not common, and it should have numerous applications. This was seen, not in the country of large toolrooms, but in far off Japan. The illustration shows its convenience.

Machining with Tungsten-Carbide

Nickel-steel piston rods for pumps, and 12½ per cent manganese-steel parts for conveyor systems have been successfully machined with tungsten-carbide cutting tools. This class of tools has also been used in machining glass of various kinds. The only difficulty in machining glass is encountered in taking the gloss off the surface. After that the operation offers little or no trouble.

The glassy coating on iron castings, given by brazing fluxes composed of borax, can be removed readily by applying an emery or polishing wheel.

Pre-Finishing Treatments for Metal Surfaces

CLEANLINESS is a prime requisite for success in enameling, japanning, or similarly finishing a metal surface, beginning with the preliminary treatment and continuing throughout the finishing process. Only the obtaining and maintaining of cleanliness in the preliminary conditioning of the surface will be considered here.

Rust, grit, lubricants, and dust must be eliminated before good finishing is possible. Rust, if allowed to remain on a metal surface, prevents proper adhesion of the finishing film to the metal and discolors it by chemical action. Oil or grease has much the same effect in preventing proper adhesion and may also act chemically on the coating materials to cause their disintegration or discoloration. Dust and grit protruding from the thin finishing film give it a rough surface which, of course, is not at all desirable.

These substances may be eliminated by one or more of several methods. They may be burned off, chemically removed with either an acid or an alkali solution, absorbed by a volatile oil such as naptha or gasoline, buffed off, or removed by sand-blasting.

The burn-off method is used where parts are large and where their fabrication includes folded seams from which it is extremely difficult to dislodge objectionable material. The process consists essentially in subjecting the parts to be cleaned to a temperature high enough to burn the adhering material and somewhat higher than that maintained in the japan or enamel baking oven. The temperature depends largely upon the metals of which the parts are built up. Higher burn-off temperatures may be used on steel parts than would be practicable on a non-ferrous product. If solder, tin, or a lead coating is present, the burn-off method cannot be used successfully. Care must also be taken to keep the temperature within limits which will not cause the metal products to warp or oxidize. Automotive parts are often treated by subjecting them to a temperature of from 600-700 deg. F. for three or four minutes, after which they are wiped while hot, then allowed to cool before dipping.

The burn-off temperature carbonizes the oil and grease adhering to a metal surface. In carbonized form, these substances fall off readily in small particles. After removal from the burn-off oven, parts are either blown off or wiped off to remove any remaining particles of carbonized fatty material or grit.

Old paint and varnish are also removed in the burn-off oven, preparatory to refinishing. A temperature of 650-700 deg. F. is necessary to dislodge the old coating, which can be wiped off with a tack rag while still hot. The burn-off oven is also a means of drying washed and chemically treated parts. The high temperature used is claimed also to have a tendency to anneal the metal, thus relieving die and riveting strains.

Several factors may limit the use of the burn-off method. The cost of the equipment required where the quantity or quality of production will not warrant the necessary expenditure, or a part of such a shape that all surfaces cannot be wiped, are two of the important ones. If all surfaces cannot be wiped, an appreciable amount of residue will adhere to the part, spoiling the finish and contaminating the finishing materials.

There are a number of chemical compounds on the market for the cleaning of metal surfaces. Since these have a wide variety of possibilities, a proper selection depends on the nature of the cleaning problem. A solution of 1 lb. of potash of soda to 1½ gallons of water has been used successfully to remove grease and similar foreign matter. The parts to be treated are submerged for about ten minutes in this solution, which is kept at the boiling point, and are then rinsed in hot water and dried thoroughly. This boiling solution will also remove old paint or varnish from parts. To remove old paint, parts are allowed to remain submerged in the solution for periods of one hour or longer, the time depending upon the number of coats to be removed and the temperature at which the previous coats were baked.

Oakite, Wyandotte, Deoxidine, Metex, or caustic soda solutions are sometimes used in place of the potash solution. These and other special compounds are used also in metal-washing machines.

Rust cannot be removed by the burn-off treatment. Heavy rust spots are usually buffed off, while a thin coating of rust is removed either by gasoline or kerosene or by pickling in a solution made of commercial sulphuric acid diluted in water. Other solutions used for this purpose are: a 20 per cent solution of sodium citrate and water, a 10 per cent solution of ferrous sulphate and water, and a 3½ per cent solution of boric acid and water. These are slower in action, however, than the sulphuric acid bath, made usually in the proportion of 1 lb. of acid to a gallon of water. A concentrated solution will not remove rust. It is also necessary to remove all traces of the acid as quickly as possible after the parts are removed from the pickling bath by neutralizing them in an alkali bath, either soda or lime, followed by rinsing in both hot and cold water. After rinsing, the parts are dried by hand or in a direct-heated oven.

Acid or soda baths cannot be used on aluminum parts or die castings. Aluminum parts are prepared for a baked finish by a thorough cleaning with gasoline or naphtha, and a subsequent oven-drying. Old paint or varnish may be removed from aluminum with a standard paint or varnish remover.

Where parts being cleaned have no folded seams, inaccessible creases, or unattainable corners, it is possible to remove grease and oil by naphtha or carbon tetrachloride dip. Parts coming from the naphtha dip are dried thoroughly before coating. Sheet-metal parts or castings require careful treatment.

Especially difficult to remove are the compounds for cooling tools during machining. This also applies in lesser degree to the lubricants used in stamping, spinning, and drawing operations. The function of these lubricants is the reduction of wear on the tools and the production of a smooth machined surface. Consequently, one of the prime requisites of such a lubricant is close adhesion to the metal. Both animal and vegetable oils are used in these compounds, such oils having a higher film-forming capacity than the usual mineral oils. Specially compounded cleaning solutions are often required to eliminate these lubricants.

Courtesy of the Young Brothers Company

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

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The International Mind

THE establishment of a school of International and Public Affairs at Princeton University, which was announced on February 22, is significant of what we in the United States must face. We are no longer sufficient unto ourselves, a body of people favored by great natural resources and separated by great oceans from the turmoil of Europe and the unrest of the Orient. We have a stake of some four billions of capital invested in other lands, which is enough to give our business men some concern, but beyond that we must be ready to play an intelligent part in the effort to untangle the problems that are holding back the march of civilization everywhere.

England is beset by unemployment at home and a dangerous situation in India. Can we be of any earthly help unless we understand something of the underlying causes? Russia is embarked on an economic experiment that may rock the world if it fails. How can we be prepared for what may fall to our lot in the event of failure unless we know more than we know now of what is behind that experiment? If we should suddenly free the Philippines what effect would that act have on other countries? Do we know?

Princeton's effort to establish a school where young men may equip themselves as well, as may be, to carry on their work, fortified by a background of understanding of what lies outside the borders of their own country, is highly praiseworthy. Would that some of our older men, in business and in industry, could have the same opportunity as these younger ones to develop the "international mind."

*

Facts for Financiers

AT SOME time in the far distant future engineers will be graduated with at least a bowing acquaintance with economics, psychology, and the use of the English language. When that time comes there will be fewer misunderstandings in the industrial world.

Those engineers who engage in the operating end of the business will have a pleasanter existence than some of their relatively inarticulate colleagues of today. They will not go before a board of directors or a financially-minded executive committee and ask for a lump sum to be expended on replacement equipment unless they have the figures to show why the purchase is economically justified. And their figures will be backed up by incontrovertible facts.

The board of directors of one large corporation had been in the habit of allowing half a million dollars annually for equipment replacement. It was not enough, but the superintendent had nothing to offer beyond a rather indefinite statement that he ought to have more money. To which feeble plea the directors firmly replied that as he had been able to get along with that amount for several years previously he could make out with it for the current year.

Then came a new superintendent who had a working knowledge of economics, a keen insight into the psychology of directors, and an ability to make himself understood. He made a survey of the equipment in the plant, listed the age of each piece and how much had been spent on it in repairs, gave the cost of new equipment and how much it would save.

When he went before the directors they cocked their shrewd financial eyes at the savings column in his report and voted him two million dollars without a murmur. It pays to know why you want to replace machines, and to be able to explain with facts that appeal to a financier.

*

Is Experience a Handicap?

ADHERING to costums, methods, or ideas just because they are old is clearly foolish. But it is equally foolish to assign high virtue to sheer newness; and some of our best-known and most influential business men are doing just that. Too many are making widely read statements which can only be construed as saying that experience is of no value, that expertness in a given art is a handicap to its progress. Though some experts are indeed reactionary and difficult to handle, such statements must be construed as over-eager bids for publicity. Experience, rightly interpreted and used, can never be a handicap.

SHOP EQUIPMENT NEWS

"Gen-Rad" and "Hy-Rad" Radial Drills

MECHANICAL feed and hydraulic feed are employed respectively in the "Gen-Rad" and "Hy-Rad" radials announced by the General Radial Drill Company, 1767 Elmore St., Cincinnati, Ohio. Speed change gear trains are eliminated in the Gen-Rad, which employs a Gibbs V-disk transmission in the head, as shown by Fig. 2. Speeds up to 3,000 r.p.m. can be arranged in twelve steps with this type of head construction. On the other machine, the Hy-Rad, hydraulic power is derived from the motor-driven pump on the head to feed the spindle, traverse the head, and clamp the arm to the column. The pump motor also drives the speed change gear trains through chains.

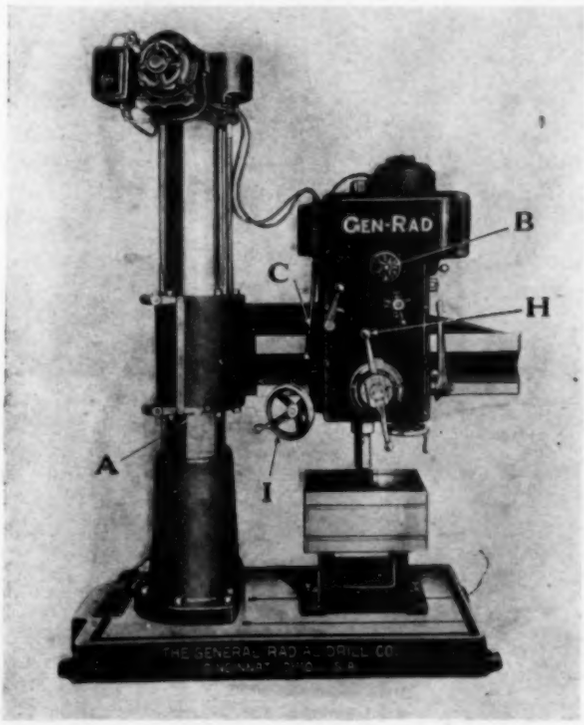


Fig. 1—"Gen-Rad" Radial Drill, which is built in column sizes of 9 and 11 in., and with 3- and 4-ft. arms. It is a general purpose type

As its name implies, the Gen-Rad is a general-purpose radial drill, and will handle up to 2-in. twist drills. Two sizes are available, the column diameters being 9 and 11 in., and the arm movements, 3 and 4 ft.

Power from the shop supply enters the machine through a revolving connection at the column base. From this point brushes take it via conduits to the column cap that swings with the arm. Provision is thus made to maintain a circuit at any position of the arm. Raising and lowering of the arm is effected by the motor mounted at the top of the column, movement being afforded by means of a worm and worm wheel. The worm wheel is engaged by a positive clutch keyed to the elevating screw, this clutch constituting a safety device that protects the mechanism from damage. Should the downward movement of the arm be blocked, it stops, but the screw continues to revolve, thereby lifting the clutch out of engagement with the worm wheel and disconnecting the power.

The column of the "Gen-Rad" is of tubular construction, consisting of an inner and an outer tube cast integral with web connections. The inner tube provides space for the conduit running from the brushes of the revolving connection, previously mentioned, to the cap on the column. The barrel on the arm is not split and completely surrounds a sleeve, which is a sliding fit on the column. Ball bearings are mounted at the top and the bottom of the sleeve to facilitate rotation of the arm and barrel. Clamping of the arm to the column is accomplished by split rings at the top and the bottom of the barrel, these rings being keyed and bolted to the barrel at its junction with the arm. A sliding fit on the remainder of the bolts in the clamping rings permits sufficient movement for the manually-operated clamp *A* Fig. 1, to bind the rings to the column. It is obviously necessary that the swinging movement of the cap should be in unison with that of the arm, and, in consequence, a guide bar runs from the arm to the cap in order that the elevating screw bearings be maintained in alignment. This guide bar also carries electrical limit switches for the vertical movement of the arm.

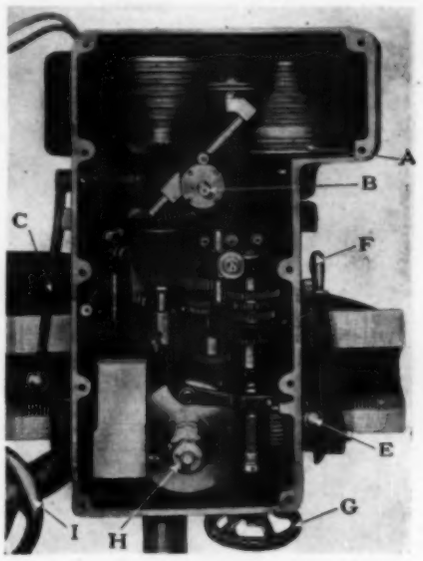


Fig. 2—Head driving mechanism of the "Gen-Rad." A Gibbs V-disk transmission affords means for twelve spindle speed changes over a range of 78 to 3,000 rev. per minute

A second motor is mounted on the head to drive the spindle and operate the feed. From the motor, power is transmitted to the Gibbs V-disk transmission, Fig. 2. A disk on the motor spindle engages the lower disk *A*. By changing the position of the idler between the two sheaves, any one of twelve spindle speeds may be obtained, and by employing the proper diameters for the various steps in the sheaves, speeds from 78 to 3,000 r.p.m. may be had to suit the customer's requirements. The star

wheel *B*, Fig. 1, is used for changing the position of the idler on the sheaves. This star wheel is carried on a short shaft, *B* Fig. 2, and is pulled forward to disengage the idler. It is then turned to required speed as indicated on the graduated dial and pushed back. An index pin locks the star wheel in position.

From the driven sheave, power is transmitted through bevel gears to the spindle and the feed change gears by a reversible clutch, which is operated by the lever *C*. Thus tapping operations can be performed. Power is then taken through a pair of gears to a familiar arrangement of sliding gears, which provide seven changes of feed, ranging from 0.006 to 0.037 in. per revolution. The power feed is engaged by a clutch operated by lever *E*, and for sensitive drilling operations this clutch may be disengaged and the spindle fed by hand by means of lever *F*. The drill is advanced to the work ready to start feeding by means of handwheel *G*, and rapid adjustment of the spindle to the position required is made by the hand levers carried on the shaft, *H*. These levers are also shown at *H*, Fig. 1. Traversing of the head on the arm is accomplished by a rack and pinion operated by a handwheel shown at *I* in both Figs. 1 and 2. Push-button controls on the head govern the action of both electric motors on the machine. Thus it will be seen that all control apparatus is entirely centralized on the head within easy reach of the operator.

The second machine, the "Hy-Rad," is equipped for feeding the spindle, traversing the head on the arm, and clamping the arm to the column by means of hydraulic pressure. This machine is built in column diameters of 15, 17 and 19 in., and with arms from 4 to 8 ft. Several features are the same as on the Gen-Rad machine just described. These similar features include: the rotary connection with the source of power, the construction of the column; the means for raising and lowering the arm on the column, and the design of the barrel and provision for clamping the same, except that on the "Hy-Rad" the clamping of the arm to the column is accomplished hydraulically. It is claimed that the provision of hydraulic feed for the spindle is a means of securing greater uniformity of feeding movement and greater flexibility of control of the feed, inasmuch as an infinite range of feed is available, and that the feed may be adjusted quickly to compensate for variations in hardness of the material being drilled.

As shown in Fig. 4, an electric motor is mounted at the back of the drilling head, this motor driving the pump, which furnishes the hydraulic pressure, and also driving the gears that furnish the speed changes. On the motor spindle there is a sprocket from which a single chain runs over a sprocket on the pump spindle, and thence, over a sprocket on each of the two horizontal shafts, going over one sprocket and under the other so that the two sprockets rotate in opposite directions. The two shafts carrying these sprockets are mounted one directly behind the other and, in addition to the main driving chain, there is an auxiliary driving chain running over a pair of sprocket wheels. Mounted on the front shaft between the two sprockets, which are free to rotate on the shaft, there is a clutch operated by lever *A*, Fig. 5, to provide for locking either of these loosely mounted sprockets to the shaft for forward or reverse rotation. This shaft extends to the left into the head of the machine and provides for transmitting power to a set of spindle

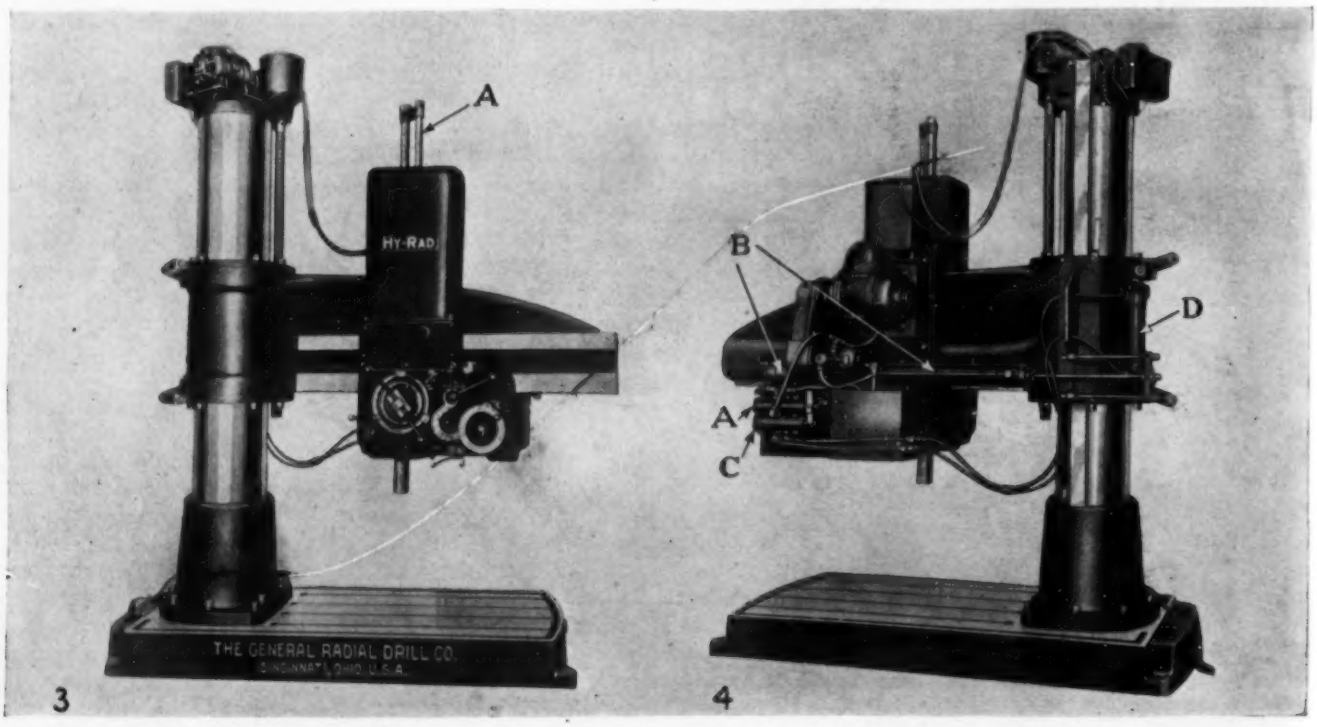


Fig. 3—"Hy-Rad" Radial Drill, which is available in 15-, 17-, and 19-in. column diameters and with arms of 4 to 8 ft.
Fig. 4—The motor mounted at the back of the head operates the hydraulic pump for actuating the feed, head traverse, and arm clamping mechanism. This motor also drives the spindle speed change gears

speed change gears mounted on splined shafts. Provision is made for shifting gears by means of an arrangement of shifter forks, these forks carrying rollers that engage with a drum-type cam, which is, in turn, manipulated by the rotation of lever *B*. Twelve changes of speed are obtained in this way, these changes being indicated by a direct-reading dial illustrated at *C*, Fig. 5 showing this part.

In the opening mentioned above it will be noted that two rates of speed are recorded. In other words, any one of the twelve rates is obtained by manipulating lever *B* and is multiplied by selective gearing on the spindle, thus making any one of 24 speeds available. This multiplication of speeds is accomplished through lever *D*. By referring to Fig. 6, which shows a detail of the spindle construction, it will be apparent that the spindle is mounted in a sleeve *A*, which is free to rotate in the head, but is held against sliding movement. The spindle is splined into this sleeve. A worm wheel *B* and a spiral gear *C* are free to rotate on the sleeve, and between these gears there is another spur gear integral with the spindle sleeve. The clutch member *D* has internal gear teeth to mesh with the spur gear, which is integral with the sleeve, and by sliding this clutch by means of lever *D* in Fig. 5, provision is made for engaging either the worm wheel or the spiral gear to furnish the high or low ratio as desired. This is the high or low speed indicated by the direct-reading dial at *C*, Fig. 5. On the machine illustrated the range of spindle speeds is from 20 to 1,058 r.p.m. Other ranges of speed can be furnished as required.

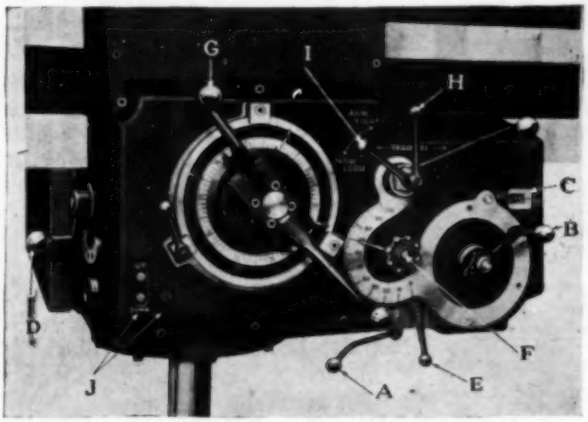


Fig. 5—Close-up of the head controls of the "Hy-Rad" Radial Drill. At *C* are shown the high and low spindle speeds for each step

The piston for feeding the spindle hydraulically is mounted directly at the top of the spindle, where it is free to rotate on anti-friction bearings. Lever *E*, Fig. 5, in its central or neutral position closes the valve which admits oil to the cylinder carried at the top of the drill spindle. By moving this lever to the left, pressure is applied for feeding the spindle downward, and by moving it to the right of the neutral position, pressure is provided to move the spindle upward. The rate of feed is obtained by means of a star wheel *F* and indicator needle running over a graduated dial, which indicates the rate of feed in in. per minute. The hydraulic spindle feed range is from 0 to 100 in. per minute.

In addition to the hydraulic feed, provision is made for moving the spindle up or down by hand. This is accomplished by means of "breaker" levers *G*. These levers are carried on a sliding shaft, which is pulled outward by means of the levers, thereby closing the valve in the cylinder through the operation of a rack and pinion actuating a cam trip. The shaft that carries these breaker levers has a sprocket wheel mounted at its inner end from which a chain runs to a second sprocket. The second sprocket causes the rotation of a pinion meshing with rack teeth cut at the lower end of the rod at *A* in Fig. 3. This rod also carries an adequate counter weight that makes raising and lowering of the spindle by hand an easy matter. From Fig. 3 it will be seen that rod *A* is connected by means of a yoke with an extension running up from the spindle.

By referring again to the rear view of the Hy-Rad machine in Fig. 4, it will be noted that there is a valve *A* placed at the rear of the head. This provides for the admission of oil in either direction in the cylinder *B*, in order to traverse the head on the arm. This movement is controlled by means of lever *H*, which has a neutral position. Moving the lever *H* to the right or left gives traverse in the required direction. By regulating the movement of the lever, and in consequence, the opening of the valve in the cylinder,

Fig. 6—Spindle construction used in the "Hy-Rad" Radial Drill

the rate at which the head is traversed may be adjusted to move the spindle rapidly toward a required position, and then stop it at exactly the required point. The hydraulic cylinder is secured to the head and moves with it, while the piston rod is held by a bracket mounted on the barrel surrounding the column.

It will also be seen from Fig. 4. that a second valve *C* controls the cylinder *D*. The piston rod in this cylinder is connected to a toggle that actuates the upper clamping ring, and the cylinder is connected to a similar toggle on the lower clamping ring. When oil is admitted to the cylinder, it moves the piston rod up and the cylinder down, thereby actuating both toggles and affording ample pressure for rigidly locking the barrel to the column. The control of the valve governing the pressure in this cylinder is accomplished by means of a lever *I* in Fig. 5.

At the front of the head there will also be noted two push-button controls, one of which governs the motor at the top of the column for raising and lowering the arm, and the other controls the motor that drives the hydraulic pump and spindle transmission gears. All control mechanisms are thus located centrally on the head and are instantly available for use. The General Radial Drill Company is an outgrowth of the former Cisco Machine Tool Company.

Buhr Hydraulic-Feed, Multi-Head Drilling Machine

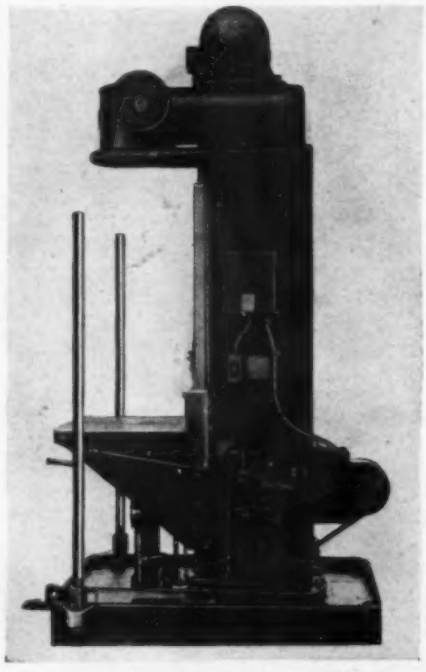
A HYDRAULIC-FEED, multi-head drilling machine embodying some of the features of its cam-operated, multi-head machine, has been placed on the market by the Buhr Machine Tool Company, Ann Arbor, Mich. A side view is given, showing the Oilgear mounting and the control mechanism. The operating mechanism has been designed with a view to simplicity and flexibility, and for the majority of operations the cycle consists of rapid advance, regular feed, and rapid return. Adjustable stops are mounted on the table to regulate these movements. Another feature is that the rapid return can be set to stop the table at any point without going to the end of the piston stroke. This stop is of the swivel type to permit table travel to the bottom of the stroke in order to facilitate the removal and replacement of tools. The operating lever is placed conveniently for the operator.

In size, the machine is large enough so that an indexing fixture with a sufficient number of stations can be provided, thereby loading enough parts to permit cutting down the machine time, so that the loading time governs the operating cycle. The capacity of the machine with a 3-in. cylinder is 3½ tons pressure.

The head of the machine has a 15-in. flange to which multiple heads are bolted. For single-spindle work, auxiliary spindle arbors up to No. 6 Morse are furnished, or special drive can be used. The head driving motor is mounted on top of the machine and drive is through either Texropes or a silent chain through a gearbox. Pick-off gears are used for the speed changes. The smallest diameter of drive spindle is 1⅞ in. and standard taper is No. 4 Morse. A 1¼-in. spindle driving slot and a 3-in. diameter spindle nose are other dimensions.

The column ways are 20½ in. wide with two 4-in. bearing surfaces 2 in. thick and with 1½ in. bearing on the back of the ways on adjustable gibs. The distance from the spindle to the face of the column is 16 in. Instead of riser blocks, the column is furnished in different heights. The standard height of column gives a distance between the table and the head of 52 inches.

A finished surface 25 in. square and a bearing on the ways of 30 in. are specifications of the table, which is counter-weighted by means of two



Side view of the Buhr Hydraulic-Feed, Multi-Head Drilling Machine, showing the Oilgear mounting and the control mechanism

⅜-in. wire cables running over sheaves in the top of the column and carrying sectional weights hanging inside of the column. On the standard machine the height of the table from the bottom of the base is 32 in. The stroke is 10 inches.

Oil cylinders are furnished with length of stroke inside to suit the operation, although for ordinary work a 3-in. cylinder with a Q.S. pump, having a capacity of 550 cu.in. per min. displacement, is furnished. The Oilgear unit is set into a separate chamber cast integral with the column and is bolted to the column by means of a flange. The pump is mounted on the base and is driven from the Oilgear unit drive shaft. The pump motor is mounted on the back of the column and drives through Texropes. Provision is made to take up slack in the ropes.

A self-locking mechanism is embodied in the table to adjust the table height with relation to the piston rod. This adjustment is 3 in. on the standard machine, and is especially desirable where different equipments are used in the same machine and facilitates set up. Two stanchions, consisting of 2-in. steel bars, are anchored in the base. They have adjustment in the base to make it possible to accurately align the machine and equipment.

The cutting lubricant is contained in the base, the capacity being 20 gal. It flows back into the column from an opening provided for and over the oil tank, keeping the oil at a normal temperature. This is desirable under severe operations where the oil is likely to thin from heating. A standard drain valve is furnished.

Improved Johnson "Super Clutch"

An improved clutch, known as the "Super-Clutch," has been brought out by the Carlyle Johnson Machine Company, Manchester, Conn. Formerly, carbon steel drop forged clutch fingers, also called clutch levers or toggle levers, have been used, but in order to further increase the wearing qualities and reduce breakage to a minimum, chrome-nickel steel fingers have been substituted. The clutch has also been improved by installing a method of locking the adjusting screw, whereby the adjustment remains where is is set by the operator. The adjusting screw cannot loosen up of its own accord due to vibration, high speed, or other operating conditions. Another improvement is the replacement of tool steel adjusting blocks with chrome-nickel steel adjusting blocks. The elimination of breakage from fire cracks in the hardening of these parts through the use of chrome-nickel steel adjusting blocks further increases the wearing qualities. A fourth improvement is the Alemite system of lubrication, which has been applied in order that lubrication may be facilitated and oil-stained products prevented, and so that the interior of the clutch is thoroughly lubricated at all times.

Manville No. 188-C High-Speed, Convertible Double- or Single-Stroke Headers

CONVERTIBILITY to either a single- or a double-stroke machine is the principal feature of the No. 188-C high-speed header developed by the E. J. Manville Machine Company, Waterbury, Conn. This machine, which is suitable for the manufacture of bolts, screws, rivets, and special upsets by the cold process, may be purchased in either form and later converted to the other type by the use of a few additional parts obtainable at any time. If, for example, a single-stroke header is used for making rivets and afterwards a character blank requiring two blows is to be made, the ready conversion of the machine to a double-stroke unit saves equipment cost and keeps overhead low.

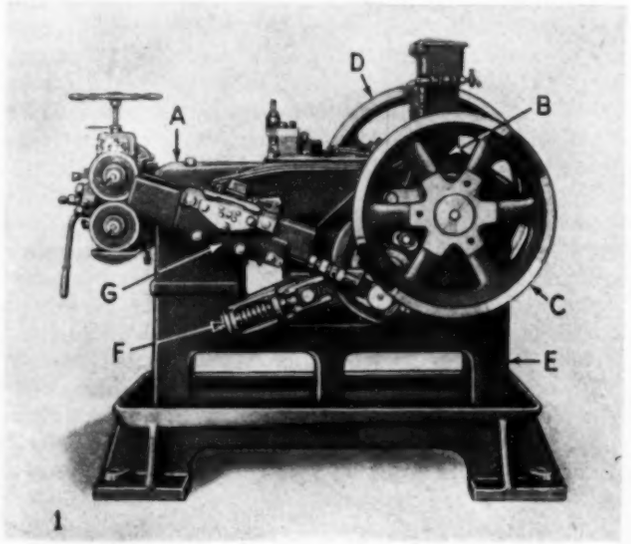
The crankshaft, pitman, driving wheel, heading ram, roll feed, and several other important parts will remain the same when converting from either a double to a single stroke, or vice versa. These, as well as the large and substantial base on which the machine proper is carried, require no changing or alteration of position.

Both models of the No. 188-C header have capacity to take $\frac{3}{16}$ in. wire, the maximum length of the blank under the head being under $1\frac{1}{4}$ in. in both cases. The maximum length of the wire blank is $1\frac{7}{8}$ in. on the double-stroke and $1\frac{1}{16}$ in. on the single-stroke unit. From 170 to 175 blanks per hour is the production of the double-stroke header and 250 the capacity of the single-stroke machine.

Referring to the illustrations, Fig. 1 shows at *A* the high-tensile, cast-iron frame of box like construction and at *B* the arch over the crankshaft journals which is cast integral with the frame, thus reducing deflection and wear on the crankshaft bearings. Balance wheel *C* on the cut-off side is held by friction, and the driving wheel *D* is also secured to the crankshaft by a friction device, which in the event of serious obstruction to the heading ram or tools will slip, thus minimizing breakage. Vibration at high speeds is eliminated by the pedestal *E*, which is well tied, rigidly constructed, and carries the frame. A patented safety yielding connection *F* connects the transfer rocker shaft with the cam, yielding in either direction, thus preventing damage to the mechanism in the event of obstruction. It also reduces wear on the transfer cam. The cut-off mechanism at *G* is of the single-roll type, operating at an angle because of the advantages in carrying over short wires. It operates horizontally in the single-stroke machine, shown in Fig. 2. In this figure is also shown the cutter bar *H*, which has three bearings: one in the cut-off bracket or housing; a cylindrical replenishable bearing in the frame, and an inboard support or bearing inside the frame. These three bearings are necessary to preserve alignment of the bar or knife with the dies.

A safety slip connection *I* is placed between the cut-off slide and the crankplate. Improved construction is featured in roll feed *J*, which has feed shaft journals replenishable and made of nickel bronze. Easy removal and replacement of either bronze bearing in the feed shaft is featured. The feed rolls are released instantly by swinging the lever in either direction. Either a solid or a split die block situated at *K* is optional, but unless specified a solid die block is furnished. Overhanging construction is featured in the heading ram *L*, which reciprocates on hardened and ground bearing surfaces that may be removed and reground in the event of wear. Because of the construction, it is impossible for blanks or abrasive substances to lodge on the bearing surfaces.

The right-hand sides of both machines are not illustrated and the following are features that apply to the mechanisms on those sides. The transfer slide is locked in the operative positions the same as in the larger size headers, and the transfer



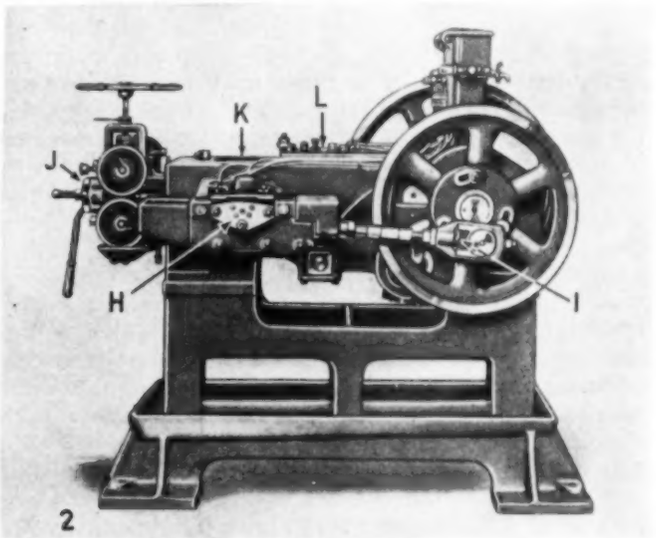


Fig. 1—Manville No. 188-C High-Speed Double-Stroke Cold Header, which may be converted to a single-stroke machine as shown in Fig. 2 by means of a few additional parts. Fig. 2—The single-stroke header, shown from the cut-off side, has capacity for 250 blanks per hour. This machine may be converted also to a double-stroke heading machine

rocker shaft of improved design eliminates trunnions. Rocker shaft is carried in replenishable nickel-bronze bearings with easy means of taking up wear. The transfer slide has a simple means for vertical adjustment. The two-piece punch holder has a hardened thrust plate.

The pitman is of high-tensile, cast steel lined with nickel-bronze, and the crankshaft is of chrome-vanadium steel, heat-treated. The journals are of large diameter and very long, the bearings being lined with nickel-bronze.

Operating the Wire Feed

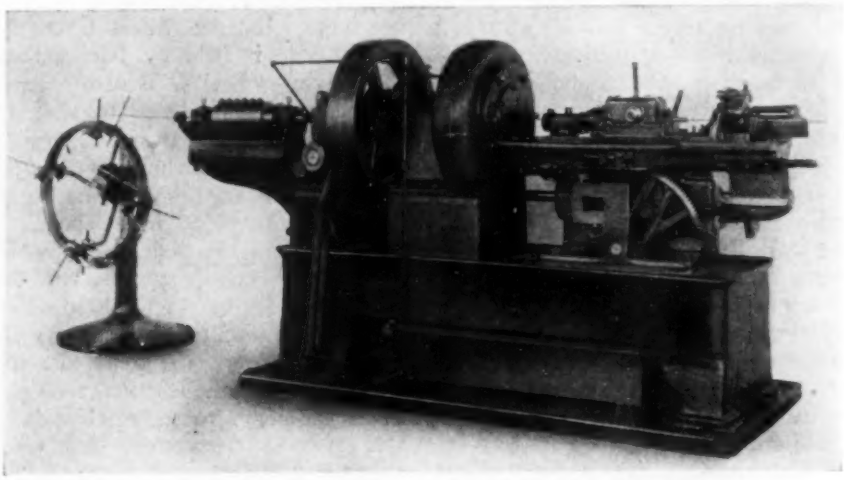
Two means of operating the wire feed are incorporated in the design. On the double-stroke machine it is effected by means of a crankplate, and on the single-stroke header by means of a rocker shaft. Ratchet feed or an eight-roller type friction is standard. The knockout mechanism is operated from a cam through an adjustable connection and plunger on the left-hand side of the machine. A feature is the safety breaking plate device, which prevents breaking or straining important parts of the machine when obstructed by a broken knockout pin. In the arch of the machine is located a standard gravity feed lubricating system with supply tank. Pipes lead to all important bearings. A patented special punch holder feature is the extension of the hardened thrust plate to the operator's side in front of the heading ram to prevent deflection of punches when compressing a large amount of metal.

Motor drive may be furnished on this machine, the motor being located on a finished plate at the rear. A bronze motor pinion meshing with teeth cut in the periphery of the driving wheel and a steel mesh gear guard attached to the machine also are furnished. The motor is not furnished unless ordered specially. A special foot brake, not part of the standard equipment, may also be had.

Among the important specifications, which apply to both machines, are the following: Stroke of heading ram, $2\frac{1}{4}$ in.; stroke of knockout, $1\frac{5}{16}$ in.; stroke of cut-off, $1\frac{3}{32}$ in.; speed of motor, 1,800 r.p.m.; horsepower required, 2. The weights are 3,025 for the double-stroke and 2,935 lb. for the single-stroke machine.

Langelier Spoke Swaging Machine

AUTOMOBILE wire wheel spokes can be swaged directly from a coil of wire on the automatic machine illustrated. This machine, which is built by the Langelier Manufacturing Company, Providence, R. I., feeds the wire continuously from the coil, passes it through a rotary wire straightening head, thence into the rear end of the swaging spindle, and finally up to the dies, where the reduced part of the spoke is swaged. The feeding mechanism of the machine pulls the wire through the straightener and swaging dies, and after each spoke is swaged, it is sheared off to its proper length. Wire up to $\frac{1}{4}$ in. in diameter is taken and spokes may be swaged up to 10 in. in length.



Langelier Automatic Spoke Swaging Machine, which will take wire up to ¼ in. in diameter and swage spokes up to 10 in. in length

The machine consists of one of the company's No. 4 open die swaging heads mounted on one end of a long box bed. The wire straightener is supported on a projecting shelf at the rear of the swaging head. At the other end of the bed are mounted the feeding and shearing mechanisms. The entire machine rests upon a pair of legs that set in large, oil-rimmed floor plates. An oil tank of large capacity is provided to deliver oil to the swaging head by means of a belt-driven pump.

The swaging head consists of a rotating spindle running in a long bronze-bushed bearing. The working end of this spindle is enlarged and has a large slot cut across its front end. This slot is lined on all sides with hardened and ground steel plates riveted in place. A round spindle plate is tongued and locked to the front end of the spindle. The front end of the swaging head is bored to receive a large bushing, which has ten holes equidistant in a circle. Into these holes are inserted hardened and ground rollers, the inner diameter of the bushing being bored large enough to expose the rollers.

Hammer blocks and dies are made in pairs of a special steel, hardened and ground, and have a sliding fit in the spindle slot. The hammer blocks have hardened and ground rollers in their striking head. When the spindle is rotating, centrifugal force causes the hammer blocks to fly out and make a striking contact with the rolls in the bushing. This action causes the dies to open and close and thus swage the wire. With the spindle running at 300 r.p.m., 3,000 blows in couples are given each minute. To enable the butt ends of the spoke to be pulled through the dies after the swaging process, the dies must be opened to a greater amount. To accomplish this, each hammer block is made in two parts to permit wedges to be inserted between the halves. These wedges are fulcrumed to a draw and push spindle located in the swaging spindle. The

draw and push spindle extends out at the rear of the swaging spindle to a heavy lever that is actuated by a cam on the camshaft at the rear of the machine. To close the dies, the wedges are pushed in, and to open them, they are pulled out.

The wire feeding mechanism consists of a slide attached to the front face of the swaging head, upon which a wire gripping head reciprocates and draws the wire through the dies while it is being swaged. The wire gripping head is actuated by means of a rack meshing with a large segment gear at the front of the machine. This segment gear is oscillated by an adjustable pivot block that is attached to a reciprocating saddle mounted on a slide, which in turn is actuated by a drum cam at the rear of the machine. By moving the pivot block up in the vertical slot in the segment gear, short spokes can be produced, and by moving it down, long spokes are swaged. The gripping device in the gripping head is actuated through a series of levers by a wiper cam on the camshaft.

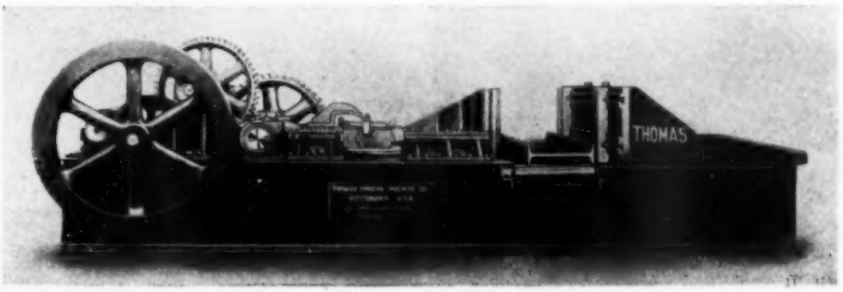
Different lengths of spokes can be produced because the wire shearing head is adjustable on the slide. This head holds the wire while the gripping head returns to get a new grip on the wire and also to shear off the finished spoke. It is also operated by a wiper cam on the camshaft. The camshaft itself is driven by a worm and wheel through a train of spur gears that are connected to a two-speed set of pulleys. One pulley drives the drum cam at a slow speed while the dies are swaging the spoke, and the other pulley drives the cam at a faster speed through the remainder of the cycle in order to save time. The belt is shifted from one pulley to the other by a load and fire device that is actuated by a cam on the end of the drum cam. The belt can be shifted to neutral at any time by the operator, should unforeseen conditions arise.

Drive to the machine is afforded by a two-pulley countershaft, one pulley driving the swaging machine spindle and the other driving the two-speed pulleys for the feeding mechanism. The wire straightener is driven by a separate countershaft. Floor space occupied by the machine is 44 x 101 inches.

Thomas Bending and Straightening Machine

STRUCTURAL shapes of all types can be straightened or bent if desired on the machine illustrated, which has been placed on the market by the Thomas Spacing Machine Company, Pittsburgh, Pa. The machine is built in 150- and 300-ton sizes and features a frame of built-up structural steel, all parts taking thrusts being riveted and welded. It is claimed that the rivets alone will carry the maximum capacity of the machine with a large factor of safety. It is understood that a stronger and lighter unit is produced by this construction. The gears are of machine cut steel, the camshaft is an open-hearth steel forging, and the ram and bolster blocks are of steel.

The machine is universal in its application to bending and straightening problems. Warped pieces are straightened and returned to their original shapes with little effort, while with a slight adjustment of the wedges, it is possible to obtain almost any desired bend in structural shapes within the capacity of the machine.

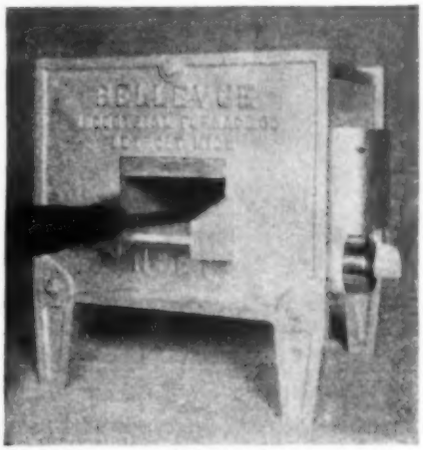


Thomas Bending and Straightening Machine

Bellevue Industrial Electric Soldering Iron Heater

For industrial establishments a repair shops, the Bellevue Industr Furnace Company, 2971 Bellev Ave., Detroit, Mich., has announce a No. E-1 electric soldering iro heater, which is of simple construction, heats quickly, and is portable. It operates on 110-volt circuits, taking 1,600 watts at 15 amp. It is furnished complete with an indicating snap switch, 10 ft. of flexible heater cord, and an attachment plug.

The over-all dimensions are 15½ in. wide by 13¾ in. high by 13¾ in. deep. The opening is 4½ in. wide by 1¾ in. high, and the chamber is 5 in. deep. Two 6 x ⅜ in. Globar elements of the cartridge type are furnished, and these



Bellevue No. E-1 Electric Soldering Iron Heater

may be replaced while the furnace is at full heat. No blower is required for operation. The heater can also be used for annealing and hardening of small parts. The finish is gray aluminum.

Oxweld No. 22 S.D. Steel Welding Rod

A welding rod for making extremely strong welds in steel, designated as the No. 22 S.D., has been placed on the market by the Oxweld Acetylene Company, 30 East 42nd Street, New York, N. Y. This welding rod has been developed especially to meet the demand for joints 100 per cent efficient in steel pipe and steel having a carbon content of 0.30

to 0.40 per cent. In general appearance, weldability, and chemical and physical properties, the No. 22 S.D. rod is similar to the Oxweld No. 1 high-test rod, but it produces welds of even higher tensile strength. It is claimed that several test coupons cut from special analysis, high-strength plate, which had been welded with a single-vee weld using No. 22 S.D. rod, showed a tensile strength of 100,000 lb. per square inch.

The action of the No. 22 S.D. rod under the welding flame is similar to that of the No. 1 high-test rod. Furthermore, it is a self-fluxing and deoxidizing rod that sparks very little. It forms a fusible slag that rises to the surface where it serves as a protective coating, which, although thin, protects the surface of the molten bath from the oxygen of the air and thus prevents oxidation. The composition of this rod also prevents the carbon from burning out during the welding operation. It fuses readily into the base metal at both sides and the bottom of the vee. This rod is available in $\frac{3}{16}$ and $\frac{1}{4}$ in. diameters and 36 in. lengths.

Despatch Indirect Gas-Fired Ovens for Japanning and Enameling

ONE of the principal improvements in the indirect gas-fired ovens announced by the Despatch Oven Company, 622 Ninth St. S. E., Minneapolis, Minn., is the use of a square tube radiator of larger surface and increased efficiency. With this radiator lower gas consumption is effected and better finished products are produced with less baking and drying time.

Atmospheric bar burners are mounted on the interior of the radiators, which are provided with control and mixing valves to secure proper combustion of the gas being burned. To the top of the radiator is connected a small, electric, motor-driven exhaust fan, which provides a constant draft through the radiator at all times, thus assuring a clean flame in any kind of weather. A radiator is usually mounted on each side of the oven. A special ventilating system is provided which takes heavy vapors out of the oven at the bottom and removes lighter vapors at the top. By proper graduation of the ventilating ports in the ducts, circulation of the heated air is insured at all times. No flame comes in contact with the volatile fumes on the interior of the oven, and, in consequence, danger of fire and explosion is minimized.

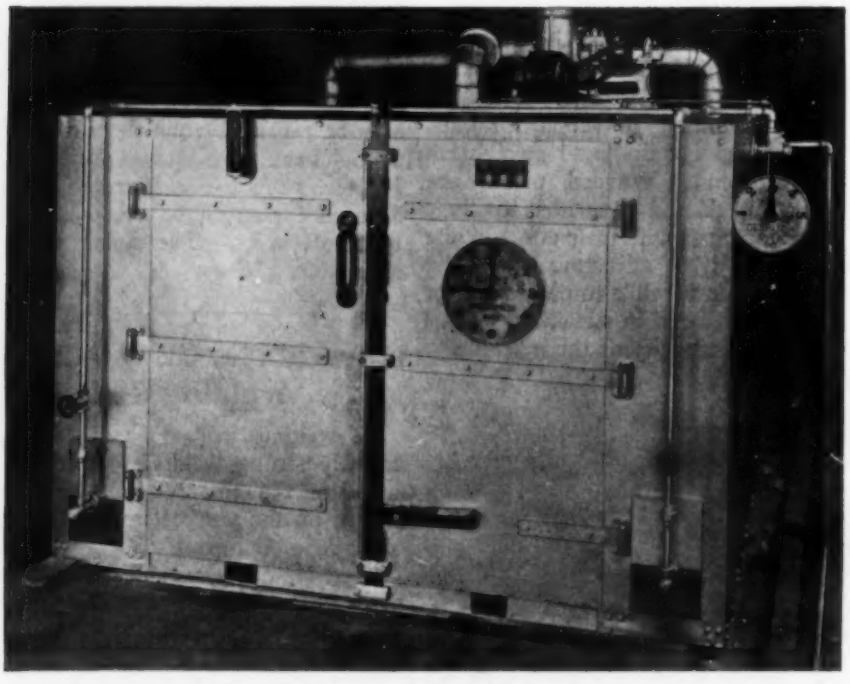


Fig. 1—Despatch Indirect Gas-Fired Oven for japanning and enameling operations

Fig. 2—Left half of the interior of a Despatch Indirect Gas-Fired Oven, showing the square tube radiator employed which prevents explosion hazards

Ample insulation is also a feature, usually 4 in. of solidified rockwool insulation being provided, although the thickness varies with the use to which the oven is put.

The heating system employed is easily controlled by a direct- throttling-type, bi-metallic thermostat, but if a more accurate and closer controlling system is desired, a Bristol thermometer thermostat is furnished to operate in conjunction with a relay and electric valve, together with the necessary pilot light, remote control switching arrangement, and fuse protection. The distribution of heat in the furnace is uniform, with the result that uniformly baked finishes are secured. These ovens are designed to meet the customer's requirements.

"Weldit" Multi-Stage Regulator

To maintain the pressure and volume of welding gases under constant control, a multi-stage regulator has been placed on the market by the

Weldit Acetylene Company, 636 Bagley Ave., Detroit, Mich. Two separate regulators are placed in one body, the first or primary stage reducing the initial tank pressure of 2,000 lb. per sq.in. to a maximum of 200 lb. This regulating unit is built of strong parts, including a German silver diaphragm, Monel metal pin, and fiber seat. The second regulator or the secondary stage is connected to the first so that the 200-lb. pressure in the body of the first passes into the second stage. As the maximum pressure is never over 200 lb., the working parts in the second stage are more sensitive in operation.

When the tank pressure is reduced below the 200-lb., the first stage is cut out automatically, and the tank pressure is directly conveyed to the second stage. In this way it is possible to utilize practically all of the gas in the tank. Screens are installed

"Weldit" Multi-Stage Regulator

to remove any foreign matter before the gas reaches the essential parts of the regulator. A dual system of safety vents is provided.

National-Cleveland Spur and Helical Gear Grinding Machine

BOTH spur and helical gears can be ground on the 4- and 8-in. gear tooth grinding machines announced

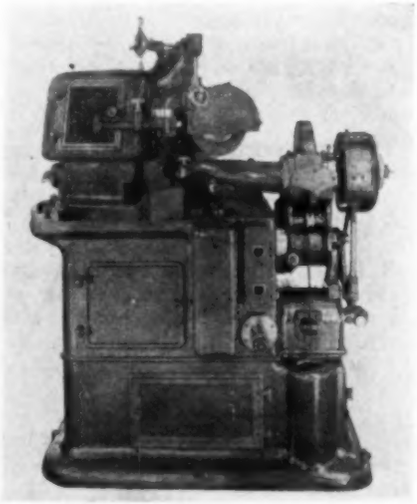


Fig. 1—Front view of the National-Cleveland 4-Inch Spur and Helical Gear Grinding Machine

by the National Tool Company, Madison Ave. at 112th St., Cleveland, Ohio. These machines are particularly suited to the production of automobile transmission gears. The 4-in. size will grind up to 6-in. pitch diameter, 2 D.P., and finer. The 8-in. unit will grind gears up to 12-in. pitch diameter, 1 D.P., and finer. Both Figs. 1 and 2 illustrate the 4-in. model.

Like the spur gear grinding machine, which has been manufactured for several years by the company, these machines are automatic in operation. Indexing from tooth to tooth takes

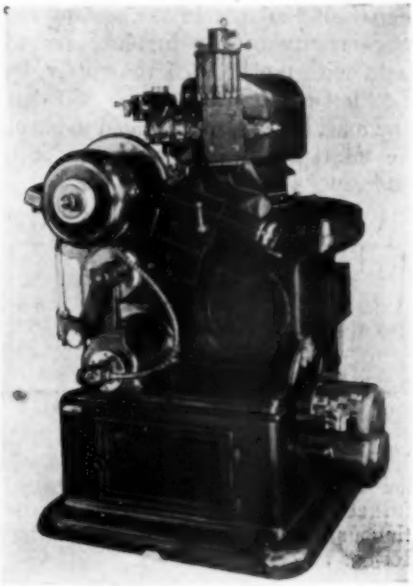


Fig. 2 — Working side of the 4-inch machine. The electrical switches are placed on this side

place at the end of each return stroke. They are furnished to grind gears to any given pressure angle from 0 to 30 deg., by simply adjusting the swivel which carries the slide. Spiral gears of any helical angle, right or left hand, may be ground to a maximum spiral of 45 degrees.

Through the tumbler feed box,

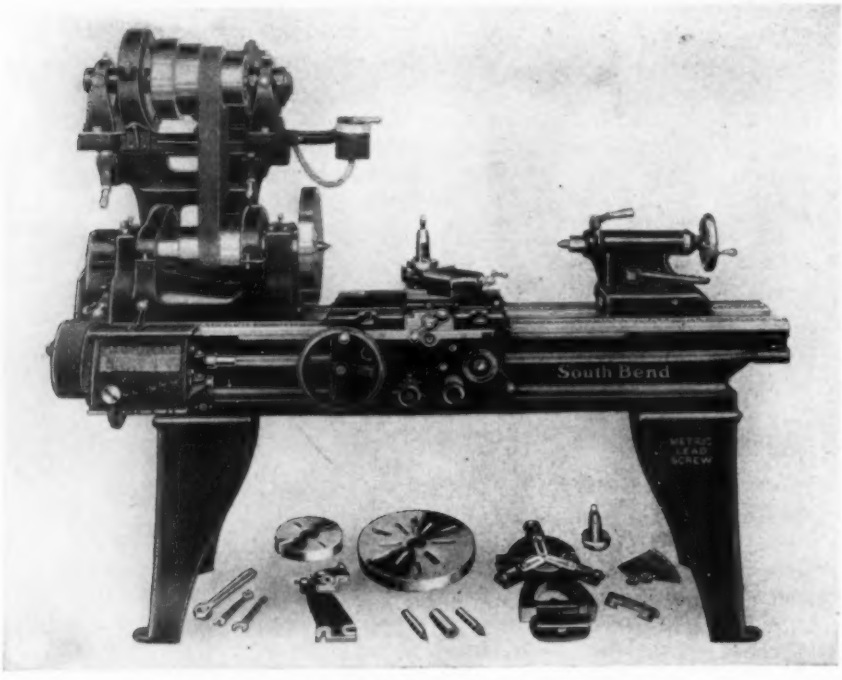
Fig. 3—The graduated swivel is located at the back of the machine

four speeds of operation, are available, namely, 32, 50, 70, and 100 strokes per minute. Centralized control is afforded by placing the snap switches and other parts to be handled by the operator at the working side of the machine.

South Bend Metric Engine Lathes

A complete line of metric system precision lathes, which are suitable for cutting a wide range of International and French Metric Standard threads, from 0.5 to 8 mm. pitch, has been announced by the South Bend Lathe Works, South Bend, Ind. These machines correspond in every way to the regular line of 1930 "New Model" backgeared screw-cutting engine lathes, being of the same construction and made in 9 in. (235 mm.) to 18 in. (470 mm.) sizes in a wide variety of styles.

These lathes are equipped with metric thread precision leadscrews, a metric gearbox and a metric-thread spindle nose. Cross feed and compound rest screws are furnished with micrometer collars graduated for regulating depth of cut by hundredths of a millimeter. The appearance of these machines resembles that of the regular line, except for the gearbox and headstock gear guard. The movement of the quick-change gear lever



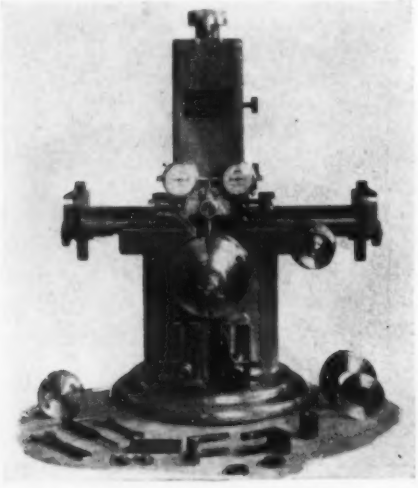
South Bend 15-Inch (385 mm.) Metric Engine Lathe

is the opposite of that on the English system lathes. Like the corresponding English system lathes, these machines are intended for the manufacture of precision master taps, thread gages, dies and fixtures.

National-Cleveland Model B Gear Checking Machine

Improvements on the Model B gear checking machine permit readings to 0.0001 in. with a one-to-one lever arm, which is mounted on ball bearings. The improved design has been announced by the National Tool Company, Madison Ave. at 112th St., Cleveland, Ohio. Ball bearings are also used on the work spindle and the base circle disks. The slide now rests on a V and a flat guide.

Repeated checkings on such parts as gears, gear-shaper cutters, and others have shown that it is unnecessary to reset the dial of the indicator, since in all instances the same reading is given. In addition to checking involute tooth forms, the machine has been found adaptable to checking the concentricity of the involute curved tooth with the bore of the cutter, by checking through an arc of 180 deg. The machine is also arranged to check the interspacing of the teeth. It is made in 4-, 6-, and 8-in. sizes.



National-Cleveland Model B Gear Checking Machine

TRADE PUBLICATIONS

CONVEYOR FURNACE. The Hevi Duty Electric Co., Milwaukee, Wis., has published bulletin No. 230 on its conveyor furnace of the floating belt type for continuous heating of small parts. Various set-ups are illustrated.

GRINDING MACHINES. The Covel-Hanchett Co., Big Rapids, Mich., has published Sections 8-30 and 1-30 of Bulletin 9 on a hydraulic grinder for general face grinding work and on the Badger line, respectively. All of these machines are clearly illustrated and described, cross-sectional views being given and specifications listed. Many attachments are also shown.

LATHES, METRIC. The South Bend Lathe Works, 409 East Madison St., South Bend, Ind., has published two bulletins describing respectively the 9- and 15-in. lathes, and the features of the corresponding metric sizes. Each size is thoroughly illustrated and all the parts are described.

MOTORS. The Triumph Electric Corporation, Cincinnati, Ohio, has published bulletin No. 2015 on its type "TR" self-start motor, which develops torques up to 300 per cent of its normal rating on starting. A cross-sectional view is given, performance characteristics are shown, and the machine is clearly described.

REBUILT MACHINERY. J. L. Lucas & Son, Inc., Bridgeport, Conn., has issued List No. 77 of rebuilt machine tools now in stock. These machines are illustrated in many cases, short lists of specifications are included, and the prices are mentioned.

ROLLER BEARINGS, HEAVY-DUTY. The American Roller Bearing Co., Pittsburgh, Pa., has published a catalog entitled "American Roller Bearings," which shows medium-duty, heavy-duty and super heavy-duty types, and gives the range of sizes and load capacities. A wide range of equipment using these bearings is illustrated, and drawings show the various methods of installation with regard to end plate construction, doweling of the inner races and control of thrust.

TURRET LATHES. The Gisholt Machine Co., Madison, Wis., has published a folder entitled "Gisholt 3-L Heavy-Duty Turret Lathe for the Railroads." The set-ups for such jobs as piston valve bull rings, piston valve bushings, and packing rings are shown. A list of other parts that may be machined is also given. Following this the specifications are listed.

PLUG AND RING GAGE BLANKS, PLAIN AND THREAD. The U. S. Department of Commerce, Bureau of Standards, has issued Publication No. 100 on the recommended commercial standards as adopted by the American Gage Design Committee, entitled "Plain and Thread Plug and Ring Gage Blanks." The material is set forth in tabular form, many cross-sectional illustrations being included. The recommendation contains 45, 9x6-in. pages and may be obtained from the Superintendent of Documents, Washington, D. C., for 15 cents.

NEWS
OF THE WEEK

The Fiftieth Anniversary Medal

A.S.M.E. Fiftieth Anniversary Celebration To Be Commemorative in Spirit

Realization of the part played by engineering in the advance of civilization stressed in plans

THE three-fold celebration marking the fiftieth anniversary of the founding of the American Society of Mechanical Engineers, to be held in New York, Hoboken, and Washington on April 5 to 9, is not so much the marking of the passing of a half century as it is an occasion for recognizing the advance of engineering through the ages. It is in this spirit that the Fiftieth Anniversary observance of that Society will be commemorated and in this spirit that the program has been arranged.

New York will be the scene of several observances, the unveiling of a commemorative tablet at the headquarters of the Society in the Engineering Societies Building following the registration, and the anniversary celebration of the preliminary meeting of the organizers at the offices of *American Machinist* on Feb. 16, 1880. After luncheon as the guests of the McGraw-Hill Publishing Company, publisher of *American Machinist*, the delegates will depart by bus for the Stevens Institute of Technology in Hoboken, where a pageant commemorating the organization meeting on April 7, 1880, there will be held. A welcoming dinner under the auspices of the Metropolitan section of the Society will be held that evening at the Hotel Roosevelt, New York. Charles M. Schwab, past president, will be toastmaster at the meeting, and Charles Piez, president of the Society, James H. McGraw, chairman of the board, McGraw-Hill Publishing Company, and Robert I. Rees, president of the Society for the Promotion of Engineering Education, will be the speakers.

On Sunday morning, April 6, special services will be held at the Cathedral of St. John the Divine. That afternoon and evening the delegates will leave for Washington, where the welcoming assembly will be held the following morning in the National Council Chamber, U. S. Chamber of Commerce Building. Presentation of greetings from engineers of other countries, from the other engineering societies, and from other organizations will be the feature of this meeting. That afternoon, the first session will be held, under the title, "The Influence of Engineering Upon Civilization." That afternoon, also, the White House reception will be held. The reception by the officers and council of the A.S.M.E. will occur that night in the Mayflower Hotel, Washington.

Tuesday morning, the second half of the session, "The Influence of Engineering Upon Civilization," will be held, the remaining monographs being presented. The Founder's Luncheon will be held at noon on Tuesday, Ambrose Swasey, past president and honorary member, presiding. That afternoon there will be a convocation for the conferring of honors at which Charles Piez, president, will present the A.S.M.E. medal to William L. Emmet, consulting engineer with the General Electric Co., the Melville medal to Joseph W. Roe, professor of Industrial Engineering at New York University, and the Fiftieth Anniversary medals to the delegates presenting monographs. At that session also, the Gantt medal will be presented to Fred J. Miller, past president, and the Guggenheim medal to Orville Wright, honorary member.

The Fiftieth Anniversary Formal Dinner will be held at the Mayflower Hotel that evening, with William F. Dyrand acting as toastmaster. Addresses will be made by Charles Piez and Dr. Robert A. Millikan, and the Herbert Hoover medal will be presented for the first time.

Wednesday will be devoted to excursions to various points of interest in and around Washington, including the Bureau of Standards, the interiors of various Government buildings, Great Falls, the Navy Yard, the city of Washington, Arlington Cemetery, Alexandria, and Mount Vernon. These excursions conclude the program.

Members of the advisory committee for the celebration, composed of past presidents and honorary members, are: Ambrose Swasey, John R. Freeman, James Hartness, D. S. Jacobus, Ira N. Hollis, Charles T. Main, M. E. Cooley, Fred J. Miller, E. S. Carman, Dexter S. Kimball, N. G. Herreshoff, John L. Harrington, Fred R. Low, W. F. Durand, W. L. Abbott, and R. S. Griffin. The executive committee has S. W. Dudley as chairman. This celebration committee includes: W. L. Batt, G. M. Eaton, F. M. Feiker, J. W. Parker, C. P. Bliss, H. R. Westcott, A. A. Adler, Admiral H. I. Cone, Dr. H. N. Davis, K. H. Condit, and A. M. Greene, Jr.

In commemoration of the event, and in recognition of the part *America Machinist* played in the founding of the Society, a special edition of *American Machinist* will be issued on April 3, comparing engineering and mechanical developments of the past fifty years. A number of special articles and pictorial features will be included in the issue.

* * *

Automobile Methods Influence Plane Interiors

Automobile interiors seemed to be the basis for the interior arrangement of many of the cabin planes on exhibition at the St. Louis (Mo.) Aircraft Show recently. The influence of the forward seat of the automobile is repeated in the arrangement of the flying con-

trols and the pilot's compartment, and the interior arrangement of the rear compartment of the usual closed car has been utilized as a basis of the design for that of the passengers' compartment. This redesign permits the utilization of automobile production methods in the production of parts for aircraft, and is possibly a direct result of the importation of a number of automobile engineers into the aircraft industry during the past year when the number of aircraft engineers available was insufficient to meet the demand. Instrument boards are also being simplified in following the lead set by automotive practice.

Production control was stressed at a meeting of the commercial manufacturers the first of the week. Among the proposals made at that meeting were those of taking a periodical sales census, and the proper form of the Chamber of Commerce production report. The production reports and the compilation of license data are aimed to assist in scheduling production to avoid either oversupply or under-supply of the market. To aid in picking up the pieces and such salvage as possible when there has actually been an oversupply or when sudden changes have been made from an old to a new model, a proposal was made to have a purchasing agent conference to exchange information on the economical purchase of experimental material in small lots, and to provide a clearing house for accumulated surplus. It was formally voted at that meeting that such a conference should be held annually, with the first meeting at Detroit.

* * * *

Washington Wonders With Donovan—Echoes of the Market —Prudence Needed in European Dealings—Reassurance for Associations—Reciprocity in Taxation

By Paul Wooton

Washington Correspondent, American Machinist

WASHINGTON, D. C., March 5—William J. Donovan's proposal for changing the Federal Trade Commission from an enforcement agency, in which the Commission is both prosecutor and court, into a judicial agency, is an attempt to give expression to the fact that the anti-trust laws and the laws to prevent unfair methods of competition are essentially economic regulations, whose administration in terms of legal definition by the courts, fails to reach through and apply the economic sense which underlies them. By successive decrees the courts have appropriated every grant of power which was originally committed to the Commission, with the result that the Commission's action now has no finality whatever.

Mr. Donovan now proposes that the Attorney General alone should have the power to bring suit for violations of the Sherman and Clayton acts and that these proceedings should be presented in the first instance, before the Federal Trade Commission, instead of a district court. The significant feature of Mr. Donovan's proposal is that all questions as to the law and the facts would be finally settled by the first court of appeals, except constitutional questions which would go on up to the Supreme Court for review as at present. Unless a special tribunal is created, as alternatively suggested by Mr. Donovan, it would appear, however, that the result sought by the procedure proposed would not be accomplished.

It now is apparent that industry prior to the stock market disturbance had been stimulated greatly by demand having its source in profits from operations in securities. These profits came in part from the use of savings. As a consequence, savings deposits and savings in other forms decreased. Now the reverse of that process is in operation, because indebtedness incurred for speculative purposes must be curtailed out of current income. Spending capacity is used in part to pay debts, rather than in the purchase of goods.

The present uncertain situation, due to the lack of confidence in the immediate future, will continue until lower money rates and falling prices create a situation which appeals as the proper time to begin operations on a larger scale. Then business is likely to revive quickly. The situation at present is one where such a turn may take place at any time. All elements essential to a protracted depression seem to be lacking. At the same time, the existing recession of business already has equalled that of 1924 and even a lower curve may be transcribed before the corner is turned.

A wide disparity of business conditions among the countries of Europe, with the general situation calling for prudence rather than pessimism, is reported by H. C. MacLean, American commissioner at the headquarters of the International Chamber of Commerce at Paris.

In a cable report to American Section of the International Chamber, made public today, Mr. MacLean describes the European economic situation as "decidedly spotty." The discrepancies existing between the situation in one country and that of another, between different forms of activity in the same country and between individual concerns of the same character make it quite impossible, he says, to arrive at a net balance that is definitely favorable or unfavorable. Mr. MacLean said:

"Enough has been said to demonstrate the danger inherent in any generalization with respect to European conditions. On the basis of the available facts, one would be inclined to take a pessimistic view, but is this really their significance? In several important cases psychological factors which are ever subject to rapid change, are playing a large part. Money stringency is another outstanding feature, but the reductions just made in the official discount rates of the United States, Great Britain, Germany, and even France, which with Switzerland, already had the lowest rate in the world, is conclusive proof that money is becoming easier. All things considered, the situation is one which calls for prudence but not for 'pessimism'."

Perhaps there is reassurance for trade associations in the rather emphatic argument made in the discussion of the administration's anti-trust policy during recent months that the scope of their activities under the anti-trust laws have been well defined. Doubtless it is true but there is evidence that some associations at least either are ignorant of the interpretation put upon the statutes by the courts or are disposed to press for a wider latitude than that which is conceded to them without question. In their enthusiasm to eliminate uneconomic and wasteful, as distinguished from unfair, competitive practices, industrial and trade groups have made numerous attempts to reach beyond discreet limits through the instrumentality of the Federal Trade Commission's trade practice conference procedure.

Ratification by American business interests of a plan for minimizing double taxation in international trade that would eliminate negotiation of treaties with foreign governments for accomplishing this purpose was sought Feb. 14 at a conference called by Secretary Mellon. Under the plan outlined at the conference, the United States would grant exemptions to foreign business, within certain limits, equivalent to the measure of relief accorded to American business abroad by the foreign governments. In lieu of treaty making the plan proposes a statutory method whereby the Secretary of the Treasury would be vested with authority to administer the doctrine of equivalent exemption. In principle, this statute would follow the provisions of the present law exempting foreign shipping companies from some taxation.

* * *

Census Bureau Mails Machine Tool Schedule

The special schedule and letter of explanation to be used in canvassing the machine-tool industry and manufacturers of dies, jigs, fixtures, and small tools, are ready for mailing by the Bureau of the Census, U. S. Department of Commerce. The schedule is in the form of a confidential government report.

Four Groups Combine In Management Meetings

"Organizing for permanent prosperity" is the keynote of the week in Chicago, where four organizations are combining in a program of management and materials handling meetings at the Hotel Stevens. The first American National Management Congress is jointly sponsored by the Management division of the A.S.M.E., the A.M.A., Society of Industrial Engineers, and the National Association of Cost Accountants, and features papers by leading engineers on the latest ideas in factory management and operation. March 5 to 7 are being given over to the Third National Materials Handling meeting, sponsored by the Materials Handling division of the A.S.M.E. During the entire week, the National Industrial Equipment Exhibition is also being held.

* * *

Steel Foundries Advise Arbitration Clause

Representing steel castings plants of the country, the Steel Founders' Society of America, Inc., has recommended to its members that an arbitration clause be incorporated in their purchase and sales contracts. At a meeting of the board of directors of the Society, recently held in Pittsburgh, it was voted, upon the recommendation of Granville P. Rogers, managing director, to enter into a co-operative arrangement with the American Arbitration Association, under which the latter's tribunal facilities would be available to all of the Society's members. The terms of the agreement entered into by the Society and the Association provide that the Society accepts the arbitration rules of the Association and approves the following arbitration clause for such voluntary use as its members may desire: "Any controversy or claim arising out of or relating to this contract or the breach thereof shall be settled by arbitration, in accordance with the rules, then obtaining, of the American Arbitration Association, and judgment upon the award rendered may be entered in the highest court of the forum, state or federal, having jurisdiction."

The Association further undertakes to furnish members of the Society with any information desired on arbitration.

* * *

Gray-Iron Business Shows Increase

Business in the gray-iron foundry industry showed an increase in January, according to the report of the Gray Iron Institute, just published. January figures for 71 major foundries showed a percentage of 89.4, as compared with 70.3 for December, and 128.5 for January, 1929. Production in 128 foundries during the month, related to normal production, showed a percentage of 88.5, as compared with 86.2 for December and 118.7 for January, 1929. Unfilled orders for 69 foundries showed a percentage of 51, as compared with 49.9 for the preceding month and 125.6 for January, 1929. Of the 110 foundries reporting on the business outlook, 16 reported good prospects and 72 fair.

* * *

Name Changed By Railway Tool Suppliers

At the last meeting of the Supply Association of the American Railway Tool Foremen's Association, it was agreed to change the Association's name to "The Tool Foremen Supplier's Association," for the purpose of embracing a larger field. The 1930 convention of the American Railway Tool Foremen's Association will be held on September 10, 11, and 12, at the Sherman Hotel in Chicago. The exhibition will open on Tuesday, Sept. 9.

* * *

EDITORS of a group of the leading trade publications were the guests of the Aluminum Company of America on Thursday, Feb. 27, leaving New York the preceding evening and returning the following morning. Included in the party was G. S. Brady of *American Machinist* and *Product Engineering*.

Obituaries

PERRIN GEORGE MARCH, 77, president of the Cincinnati Shaper Co., died Feb. 26 at his home in Cincinnati. He had been inactive for more than three years, and his death was attributed to the result of a shock received a month ago. Mr. March was identified in the machine-tool trade in Cincinnati for more than 40 years. He was a member of the board of directors of the Ohio Mechanics' Institute for years, and was president at the time when the present Ohio Mechanic Institute Bldg. was erected. In 1887, when the Centennial Exposition was conducted in Cincinnati, he was one of the commissioners in charge of arrangements.

JACOB D. COX, 77, founder of the Cleveland Twist Drill Co., Cleveland, who retired in 1918, leaving the direction of the company to his sons, Samuel H. and Jacob D. Cox, Jr., died on Feb. 23 at Pasadena, Calif. He came to Cleveland from Warren, O., in 1868 and entered the employ of the Cleveland Iron Co. as rod turner. The Cleveland Twist Drill Co. was incorporated under Ohio laws in January, 1904, and succeeded the firm Cox & Prentiss, which was the successor of Newton & Cox, the firm name of Mr. Cox's first venture in twist drill manufacture. Mr. Cox remained as chairman of the board after his retirement from other business.

WALTER MILLER, 80, Cleveland mechanical engineer for nearly fifty years, died on Feb. 27 at his home in Painesville, Ohio, where he had moved after his retirement in 1918.

DR. WILLIAM H. NICHOLS, leading manufacturing chemist and president of the Nichols Copper Co., died on Feb. 23, at the age of 78, in Honolulu, Hawaii. Dr. Nichols was also a chairman and director in a number of other manufacturing and business enterprises.

CECIL R. PILSBURY, assistant treasurer of the General Steel Castings Corporation, Granite City, Ill., died at Philadelphia on Feb. 20, following an operation for acute appendicitis. Mr. Pilsbury was 53 years old.

JOHN HENRY LONGMAID, 69, president of the Esterbrook Steel Pen Manufacturing Co., Camden, N. J., died at his home in Bryn Mawr, Pa., on Feb. 17.

ARTHUR J. HAYES, 60, formerly resident manager of the U. S. Cast Iron Pipe Co., Burlington, N. J., died recently at his home in Buffalo.

EDWARD C. FISHER, 55, district sales manager of the American Locomotive Co., died recently at his home in St. Louis.

Forthcoming Meetings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Fiftieth Anniversary celebration. Opens in New York, April 5, afternoon in Hoboken; April 6 in New York; April 7, 8, and 9 in Washington, D. C., at the Mayflower Hotel. Calvin W. Rice, 29 West 39th St., New York City, secretary.

AMERICAN FOUNDRYMEN'S ASSOCIATION — Annual Convention, Cleveland Public Auditorium, Cleveland, Ohio, May 12-17. C. E. Hoyt, 222 W. Adams St., Chicago, is secretary-treasurer.

SOCIETY OF AUTOMOTIVE ENGINEERS —1930 Summer Meeting, French Lick Springs Hotel, French Lick Springs, Ind., May 25-29. National headquarters are at the Engineering Societies Bldg., 29 W. 39th St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS — Semi-annual meeting, Hotel Book-Cadillac, Detroit, June 2 to 12. Calvin W. Rice, 29 West 39th St., New York City, is secretary.

NATIONAL ASSOCIATION OF FOREMEN —Convention at Toledo, Ohio, June 6-7. Harry J. Baumker, 316 Tenth St., Toledo, is convention secretary.

STEEL INDUSTRY'S EXECUTIVES—Annual Iron & Steel Exposition. Under the sponsorship of the Iron & Steel Electrical Engineers, June 16-20, Broadway Auditorium, Buffalo, N. Y. John F. Kelly, 1010 Empire Bldg., Pittsburgh, Pa., is managing director.

AMERICAN SOCIETY FOR TESTING MATERIALS—Annual meeting, Haddon Hall, Atlantic City, N. J. June 23-27. C. L. Warwick, 1315 Spruce Street, Philadelphia, is secretary-treasurer.

BUSINESS · BAROMETER

Chief need at this time is vigorous action to convert depressed attitude into one of cheerfulness

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

ALTHOUGH politics is the most important business that modern democracies have to deal with, many business men abhor anything which threatens to effect a change in the political *status quo*. For this reason the week's developments have engendered some pessimism, and the feeling on both sides of the Atlantic seems to have become a little less cheerful than it was.

In Europe the progress toward naval disarmament has been slowed down by the political situation in France, and by the opposition of Lords Beaverbrook and Rothermere who are trying to form a new political organization to be known as the Empire Party. According to the unwritten and imaginative prospectus that is current this Empire Party is to have as its slogan "The British Empire for the British," and in pursuance of this objective the trade of the Empire is to be protected by a tariff wall that will exclude the products of other nations and further obstruct the world's commerce.

The idea is not new, but the depression that prevails in England makes the people responsive to anything that promises to improve economic conditions, although it is realized that the changes involved might be very radical and strongly opposed by the leaders of the present Conservative Party.

In the United States a similar feeling of disquietude prevails. It appears to be chiefly a result of the unwillingness of Congress to accept President Hoover's recommendations with regard to the various questions of public interest that are now under consideration in the House or in the Senate.

Three of these questions are supremely important. One is the tariff. There are many who now doubt whether any revision of the present schedule will be adopted before the adjournment. This is seriously disturbing to those who had calculated upon an advance in duties by which they would be benefited.

Then there is the question of farm relief. Merchants and dealers in agricultural products are very much embittered because the Co-ops, and the Co-ops only, appear to have been the beneficiaries of the policies adopted. As a result a widening breach between the merchant and the farmer has opened.

Finally there is the President's plea for economy in the expenditure of public moneys. In a statement issued last week he points out that an increase of 40 per cent in taxation may be necessary if all the worthy appropriation bills introduced in Congress are passed, and the covert threat implied has caused no little concern among investors who would be seriously upset by a substantial advance in state or national taxation.

As a result of the unsettlement that now seems likely to prevail until these matters are disposed of one way or another, last week's markets were rather weak, and sharp declines were registered in wheat and cotton as well as in several other agricultural products.

But the decline has not developed any new features of importance, and it appears to reflect the change from hope to discouragement rather than any radically new development in the situation.

This is a brief but accurate summary of the present outlook. The depression that it connotes is largely mental. If accurate figures were available it would probably be found that most wage-earners are spending about as much as they were a year ago at this time. The only difference is that last year's expenditures were made with cheerfulness while this year's disbursements appear to be made with regret.

Taking the country as a whole it does not make much difference whether the chalk-marks on the brokers' blackboards show that we are worth more or less than we were in March, 1929. Measured in things and taken collectively, the country is far richer than it was when everyone wanted to buy stocks, but the disposition to discount the future has been checked and lethargy is never effervescent or sparkling.

From this standpoint our chief need at present appears to be pep. It is a modern word, but everybody knows what it means and those who have but a limited supply of it are urged to procure more at the earliest opportunity. It is about the only thing that is required to convert the present feeling of depression into a consciousness of the prosperity that we are enjoying.

A check to the expansion of the steel industry is reported. Otherwise the industrial news is not important, and is obscured by the mercurial changes in the commodity markets. In the past the melancholia produced by a general decline in commodity prices has been hard to correct until some natural leader of men appeared upon the scene and took command of the markets as well as of the minds of those who make them.

In the light of history it seems almost certain that we are rapidly nearing the time when some such conflict will be staged by the compulsion of events, and it is strongly advised that those who have any reason to be interested in the purchase of the world's basic commodities should make a thoroughgoing examination of the facts by which the commercial price equation is affected.

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From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page

IMPROVEMENT in the outlook is reported by machinery and machine-tool dealers throughout the country, although sales have not yet justified the optimism of the past two months. Many districts report gains for February, even though they are in most instances slight, a result perhaps of the popularity of the year's shortest month for mid-winter vacations for executives. March is expected to bring better conditions, an improvement which will be emphasized as the year opens. Inquiries still continue in record volume, for all classes of machinery, although mainly for single items.

NEW YORK business is spotty, with improving conditions and considerable buying "on tap." Detroit reports increasing inquiries from automobile manufacturers, and the expectation of a good March. Canadian dealers report continued expansion, with most metal-working industries busy. Most Cincinnati dealers and manufacturers report slight gains in both inquiries and orders.

INDIANAPOLIS conditions are spotty also, but the possibility of automobile, aircraft, and road-builder's equipment business makes many dealers optimistic. New England buying is also improving, and manufacturers in most sections are busy. Chicago sales are better at this time. The Southern District is slow.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine-tool business

THE following reports, gathered from the various machinery and machine-tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW YORK

Spotty conditions still predominate in the New York machinery and machine-tool market. While an occasional dealer reports a good week, and a good month's business, the majority report no improvement for the week or for the month, some even claiming a slight falling off. A large amount of the business which was expected to swell February's sales total is being held over until March, possibly as a result of the increasing popularity of the month of February as a mid-winter holiday for executives of this district. The inquiries, however, are holding up as well as ever, and indicate a good deal of buying "on tap." Inquiries display the same characteristics as orders, in that they are mainly for single items and from a wide variety of fields. Only one list of any consequence has been reported within the last two weeks. Closings for the most part are for replacement or maintenance purposes. The used tool market shows the same condition as the new tool market.

DETROIT

The general outlook in the machinery and machine-tool field is still improving steadily and according to the indications of the past few days will probably continue to improve.

The representative machinery dealers are receiving an increased volume of orders and it seems likely that March will be a much better month than February. Most of the orders are for replacement equipment but a few plants are buying for other uses.

No large orders have been reported recently but inquiries from automobile manufacturers are increasing in number. Many of the large companies are going forward with plans for increased production, although these plans are still indefinite in most cases. A number of significant changes in design are being contemplated and these changes will probably involve the purchase of a large amount of machinery.

The automobile industry is much more prosperous than it was a month ago and this is reflected in the attitude of the manufacturers toward expenditures. While there is no tendency to rush into a heavy program of buying, it is apparent that the hesitancy of December and January has almost entirely disappeared.

CANADA

Keeping pace with general industrial conditions, the machinery and machine-tool market in Canada is gradually expanding. Car-building plants are well employed, locomotive shops are increasing their working staffs, general foundrymen are busy, and steel mills in all sections of the country report increased activity. A matter of far-reaching importance is the recent announcement that the Canadian Pacific Railway intends spending during the present year a sum of $50,000,000 on new equipment, new branch line construction and improvements to existing equipment. During the last fortnight the C.P.R. placed $4,000,000 railroad equipment orders.

CINCINNATI

A slight gain was made in February by the majority of the machine-tool manufacturers of the Cincinnati district, comparing it to the previous month. The greater portion of the concerns made a slight gain in the past week, comparing it to the previous week, and in no case was a falling off of business reported.

The general opinion is that the business trend is upward, with prospects that the sales-curve will climb to a higher level this month. A large volume of business is pending, it is stated, but buying of actual needs is still delayed because of hesitancy of users in making commitments.

The week's business was largely made up of orders from general machinists and miscellaneous users, whose requirements in the main were single tools and replacements. These buyers were well scattered over the country and their requirements were well diversified as to sizes and types. There was some small buying by railroads, with here and there an order for two or three tools. A few small orders were received from makers of automobiles as well as from makers of parts and accessories.

Inquiries flowed in during the week from all parts of the country, the majority of these being from general machinists and miscellaneous users. In the majority of cases the requirements were single tools and replacements, but here and there was an inquiry for two or three tools.

Selling agents report a fairly good volume of business in the past week. The market is opening up in this territory, it is stated, and there are many indications that considerable business that is pending will be closed in the very near future.

INDIANAPOLIS

While the volume of sales for machinery and machine tools in this section seems to be holding up well, there has been a spotty condition developing during the last two weeks that is causing some uneasiness among some manufacturers. Others, however, point to the large volume of business that is pending as justification for their optimistic views. Most of the automobile factories served by the trade here have curtailed their production and also their buying, and it is doubtful if there will be much increase until later in the spring.

At the present time a big volume of inquiries is coming from the users of contractors' equipment. This is particularly true among the buyers of road-paving equipment.

A brisk demand for small equipment, particularly machine shop equipment, is coming from the various airports throughout the state. This business, which jumped into prominence in Indiana last year, has developed into big proportions as more and more cities establish airdromes and install repair facilities.

A fair demand is reported from the railroads, though the volume is not what is desired. The furniture factories also are making some purchases.

NEW ENGLAND

New England industry is more active than at any period this year. The increased volume of unemployment reported from all New England states during January, showed a vast improvement during February. Massachusetts and Rhode Island were more generally affected.

New Hampshire showed a marked dullness among woodworking plants, and machinery sales to that field were affected. Connecticut, Maine, and Vermont were only seasonally dull, with the machine-tool industry in Connecticut less affected than in any state of the group. All dullness is described as a temporary condition, and reports exemplify the fact that only a very small surplus of skilled labor is idle.

While February machine-tool sales throughout the territory reflected a general improvement, buying in no industrial center has approached an aggressive, spirited stage. The step up during the month was slight. Some branches of the eelctrical and metal working industry were good buyers, and foreign sales upheld the promising aspect of the past few months. Movement of machine tools to the aeronautical and automotive industries was negligent. General buyers and the railroads were seasonally prominent.

CHICAGO

Such improvement as was noted a week ago in the machine-tool business is reported by distributors and dealers to have held, with possibly a slight gain. No transactions involving any large sales are mentioned, the business done being chiefly limited to single tools and small lots. In a few cases February has shown some increase over January, but this is the exception rather than the rule, most machinery concerns reporting but slight change. Negotiations pending indicate that, as has been forecast, the month of March will see the closing of a volume of business that will bring the average for the first quarter of this year up to a level of within about twenty per cent of that of the same period last year. The International Harvester Co. has closed on several additional items for which it has been in the market.

Railroad buying of shop equipment is reported as showing no recession, nor is any expected for some weeks to come. Industrial demand still is backward, but the inquiries coming in daily seem to warrant the belief that the near future will bring a number of new factors into the buying field. Business in used tools is being maintained at a fairly good level.

SOUTHERN DISTRICT

Quietness characterized the machinery and machine-tool business the past fortnight, and indications are that while general optimism prevails there is relatively little evidence bearing on improvement for the near future. Railroads continue the most active buyers at present. Atchison, Topeka & Santa Fe developed inquiry in the Southwest section, while scattered inquiry was made by Missouri-Pacific.

Sales of both new and used tools continued dull, and while January business was reported as better than for the same month last year, sales in January, 1929, were conceded to have been extremely poor. Some important developments were announced in the Birmingham territory recently, notably among which was the Gulf States Steel Co.'s announcement of an unusually large program at Gadsden, Ala., to extend over the next three years. With exception of activity in the shipyards at Mobile, general machine-tool business was reported as quiet, with the same inactivity all along the line as far as Jacksonville, Florida and vicinity.

Business Items

The Modern Tool Works, Rochester, N. Y., a division of the Consolidated Machine Tool Corporation of America, has appointed new agents for the Indianapolis and Cincinnati territories. George H. Diers, 2514 McMicken Ave., Cincinnati, has been appointed sales representative in the Cincinnati territory and the Thompson Tool & Supply Co., Odd Fellows Bldg., Indianapolis, will represent the company in the Indianapolis territory.

The Carl A. Norgren Co., Inc., Denver, Colo., has been purchased outright by the General Instrument Corporation, and the entire plant will be moved to Los Angeles, Calif., at once, according to the announcement of Herbert E. Linden, Pacific Coast manager for the Bendix interests, of which General Instrument Corporation is a subsidiary.

The Monarch tractor division of the Allis-Chalmers Co., Springfield, Ill., has increased its forces since the first of the year to 550. Steel construction on the new $350,000 manufacturing and storage plant has been completed, and the building is scheduled to be ready for occupancy within two months.

The L. Newman Tool, Die & Machine Works, Oakland, Calif., recently moved into larger quarters, where more space has been given to a special department for the designing and development of new machinery. The "Little Giant" washing machine, owned by a San Jose, Calif., firm, is being built in the shops, and several other machines, including a new saw filer, are being developed.

The Watling Manufacturing Co., 701 West Washington Blvd., Chicago, has purchased from the Houdaille-Hershey Corporation, a factory building at 4640-60 West Fulton St., that city. The plant consists of a 1- and 2-story, mill-constructed building, 195x130 ft., with a total floor space of about 27,000 square feet.

To take care of increasing business in stainless and other alloy steels and in their carbon steel casting trade, the Canada Electric Castings Co., Ltd., has taken over the Tudhope Metal Specialties factory at Orillia, Ont., which will give the company an additional 12,500 sq.ft. of manufacturing space.

The Indianapolis Machinery & Supply Co. has opened a steel warehouse in conjunction with its machine-tool and mill supply business. Approximately 85,000 sq.ft. of floor space are included.

The Electric Steel Foundry Co., Berkeley, Calif., occupied a new $50,000 factory building on March 1. The structure provides 12,500 sq.ft. of floor space, and will be used in connection with the former building of 5,000 sq.ft.

The Chicago Pneumatic Tool Co., 6 East 44th St., New York, has opened a branch office at 327 Philcade Bldg., Tulsa, Okla. George J. Lynch has been appointed district manager in charge of the office and the territory it serves.

The Reliance Manufacturing Co., Massillon, Ohio, has moved its Chicago office from 736 Peoples Gas Bldg. to the fifth floor of the Straus Bldg., Chicago. The office is in room 1513 and is managed by E. C. Gross.

Machinery is being installed in the new factory of Electric Auto-Lite, Ltd., Sarnia, Ont., and the company expects to be in production shortly. The new plant is the first of four units which are planned to handle future developments.

The Chamberlain Corporation, Waterloo, Iowa, has let a contract for a $25,000 one-story steel construction factory unit, 100x60 ft. Machinery and equipment will cost $19,000 and the building $6,000.

The Porter-Cable Machine Co., Syracuse, N. Y., has appointed the Triplex Machine Tool Co., 50 Church St., New York City, as dealers for the company's line of manufacturing lathes in New York City and vicinity.

The General Machinery Corporation, Boston, has moved from Summer St. into larger quarters in the new United Shoe Machinery Bldg., at 140 Federal Street.

The J. A. Fay & Egan Co., Cincinnati, Ohio, celebrated during February its 100th anniversary.

The Metal Finishers' Machine Co., Cleveland, Ohio, has moved its general offices and factory from 1931 to 2231 West 61st Street.

The Electric Machinery Manufacturing Co., Minneapolis, Minn., has moved its Detroit office to 10-230 General Motors Bldg., Detroit.

The Empire Knife Co., Winsted, Mass., will be sold to pay bondholders.

Personals

GRAHAM H. ANTHONY of the Veeder Root Co., Hartford, Conn., and CHARLES T. JONES, secretary of the Billings & Spencer Co., Hartford, were elected directors of the Billings & Spencer Co. at the annual meeting Feb. 24. Other directors were re-elected.

H. L. BARNES, formerly secretary and general manager of the American Forge & Machine Co., Canton, Ohio, was recently elected president and general manager to succeed H. C. HAIGHT. O. M. ABT is now vice-president and E. C. KEAFER is secretary-treasurer.

D. A. BIRDSEYE, formerly western sales manager of the Lake Erie Bolt & Nut Co., Cleveland, has been appointed Detroit district manager of the recently merged interests of the Lamson & Sessions Co., Cleveland, with offices in the General Motors Bldg., Detroit.

GEORGE F. BICKFORD, formerly with the Jones & Lamson Machine Co., has become identified with the Hartford, Conn., sales office of Henry Prentiss & Co., New York. He fills the vacancy caused by the recent death of J. H. Peckham.

WILLIAMS H. BASSETT has been elected president of the A.I.M.E. for 1930. Mr. Bassett first won public attention in 1925 when he was named

the James Douglas medallist for that year. He was from 1900 to 1902 a research metallurgist with the New Jersey Zinc Co., Newark, N. J., then chief chemist and metallurgist of the Coe Brass Co., Farmington, Conn., for nine years and in 1912 was made technical superintendent and metallurgist of the American Brass Co., Waterbury, Connecticut.

H. R. BUNGAY, JR., has been placed in charge of the recently established sales office of the Yale & Towne Manufacturing Co., Stamford, Conn., at Syracuse, New York.

RODNEY CHASE, of the Chase Brass & Copper Co., Waterbury, Conn., is in Europe.

E. A. S. CLARKE, secretary of the American Iron & Steel Institute, 75 West St., New York, is on a vacation in Bermuda.

W. E. CORRIGAN, formerly in charge of the San Francisco office of the American Locomotive Co., has been placed in charge of sales in the Pittsburgh district, succeeding OTIS R. HALE, who has been transferred to the Pacific Coast in the former capacity of Mr. Corrigan.

WALTER C. DOERING, St. Louis, has been elected vice-president of the American Steel Foundries.

EDWARD EBBELWHITE, of the Evans-Wallower Zinc Co., Monsanto, Ill., spoke on "Production of High-Grade Electrolytic Zinc" at the last monthly meeting of the A.I.E.E. in St. Louis.

W. R. ENGLAND, formerly with the Truscon Steel Co.'s office at Atlanta, Ga., as a special representative in the building and airplane hangar division, has been appointed district manager of the Birmingham, Ala., office.

C. F. FARR, secretary and treasurer of Beard, Campbell & Co., Port Huron, Mich., has taken over the duties previously handled by E. D. Campbell,

formerly vice-president, who died recently.

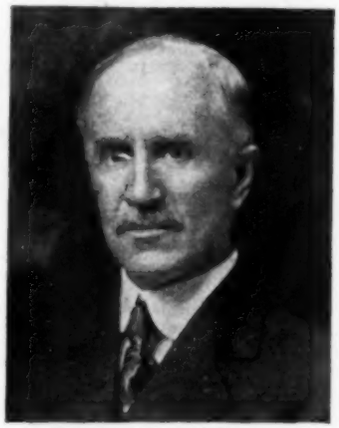
H. F. FOOTE has been appointed a fellow of the Mellton Institute of Industrial Research, Pittsburgh, under the fellowship established by the Gas Industries Co., Inc., Pittsburgh.

FRED C. GARDNER, treasurer of E. C. Atkins & Co., Indianapolis, has been named vice-president of the Columbia Club of Indianapolis.

CHARLES L. HARDING, president, and CHARLES H. HOLMES, treasurer of the Holmes Manufacturing Co., New Bedford, Mass., have resigned. DANIEL R. WHEEDON of Boston has been elected treasurer.

H. H. HARRIS, president of the General Alloys Co., Boston, and partner in Noble & Harris, Detroit, consulting engineers, has been elected to the board of directors of Aviation Consolidated, Incorporated.

JAMES N. HEALD, treasurer for 26 years of the Heald Machine Co., Worcester, Mass., and also general manager, was elected president at the annual



meeting recently. RICHARD A. HEALD, secretary, has been elected treasurer to succeed James Heald. ROGER N. HEALD continues as vice-president and works manager, and SILAS T. MASSEY continues as assistant general manager and sales manager.

O. C. HENDRY, formerly of Oakland, Calif., has been placed in charge of the Seattle office of the Detroit Steel Products Company.

HENRY HUSS has resigned as manager of the Shaw-Crane-Putnam Machine Co., Muskegon Heights, Michigan.

VIRGIL JORDAN, New York, economist of *The Business Week*, spoke on "Common Sense and the Business Outlook" at the annual meeting of the Cincinnati branch of the National Metal Trades Association on Tuesday, March 4, in Cincinnati.

H. S. LORD, general sales manager of the Nichols & Sheppard Co., Battle Creek, Mich., a unit of the Oliver Farm Equipment Co., has resigned.

FREDERICK A. MELMOTH, formerly in charge of the foundry of Thomas Firth & Sons, Sheffield, England, has been appointed technical director of the Detroit Steel Casting Co. He will have charge of production methods and also direct the development of special alloy steels.

L. FORD MERRITT has been appointed Detroit district manager of the Union Chain & Manufacturing Co., Sandusky, Ohio.

LEO MERRYMAN, assistant to the vice-president and general manager of manufacturing for the American Radiator Co., New York, has been appointed manager of the Pierce plant of the company at Buffalo.

W. C. MINIER and F. C. LORENZ have been added to the Cleveland sales and engineering staff of the Reading Chain & Block Corporation, Reading, Pa. Mr. Minier was formerly connected with the Shepherd Crane & Hoist Co. and Mr. Lorenz was for years connected with the Cleveland Electric Tramrail Company.

L. MUSCAT, of the United American Metals Corporation, Brooklyn, was elected temporary chairman of the Institute of White Metals at the organization meeting held in New York on Feb. 14. Other temporary officials were WALTER SCHOENBACH, American Lead Co., Indianapolis, secretary, and JERRY KATZ, American Metal Co. Ltd., New York, treasurer.

KATHLEEN F. O'BRIEN has been elected assistant treasurer of the American Steam Pump Co., Battle Creek, Michigan.

JAMES W. RAWLE, vice-president of the J. G. Brill Co., Philadelphia, has been elected president of the Pennsylvania Manufacturers Association, to succeed JOSEPH R. GRUNDY, resigned.

EARL F. REINHART, for the past 15 years associated with the Pullman Car & Manufacturing Co., Chicago, has joined the combined Latrobe Tool Co. and the J. M. Carpenter Tap & Die Co., in the capacity of assistant to the president.

E. M. ROBINSON has been appointed sales manager of the United States Stamping Co., Moundsville, W. Va. He has been assistant to F. S. EARNSHAW, secretary and treasurer.

EARLE W. SLOCUM, who was connected with the Chrysler Corporation, Detroit, for several years, has been appointed Michigan representative of the Henry & Wright Manufacturing Co., Hartford, Conn., with offices at 233 Curtis Bldg., Detroit.

E. J. SMITH has resigned as treasurer of the Stoughton (Wis.) Co. to become treasurer of LaFayette (Ind.) Steel Products, Inc. JAMES R. BROWN is acting as treasurer of the Stoughton Co. temporarily.

FRANK C. SMITH has become associated with the Norton Co., Worcester, Mass. He was formerly associated with the Worcester Pressed Steel Company.

COL. FRANK E. SMITH was elected a director of the Budd Wheel Co., Philadelphia, at the stockholders' meeting on Feb. 18.

SAMUEL C. STANNARD, formerly manager of the Ingersoll-Rand Co. of Colorado, has resigned to accept the newly created position of marketing manager of the Colorado Fuel & Iron Co. steel division. E. H. DICKENSON will succeed Mr. Stannard in the Ingersoll-Rand organization.

CHARLES N. STEVENS, for the past six years general manager of the Kenosha Boiler & Structural Co., has resigned to become general manager of the Milwaukee (Wis.) Boiler Manufacturing Company.

WILLIAM H. TUDER, formerly associated with W. J. Holliday & Co., Indianapolis, has been appointed manager of the steel department of the Indianapolis Machinery & Supply Co., at the warehouse offices, 1959 S. Meridian Street.

RUSSELL VOORHEES has become service manager for Varney Air Lines, Portland, Ore. He will direct work of 50 men on the company's fleet of ten planes. He has served as expert for the Wright Motor Co. plant and, in 1927, serviced Colonel Lindbergh's plane in Panama and Cuba.

J. R. WEAVER, superintendent of the manufacturing equipment department, Westinghouse Electric & Manufacturing Co., was the guest speaker at the February meeting of the Engineers Society, Milwaukee. He gave an illustrated lecture on "Arc Welded Jigs, Fixtures, and Machine Tools."

C. K. WEHN has resigned as Pittsburgh district manager of the H. K. Ferguson Co., Cleveland, to become vice-president and general sales manager of the Pennsylvania Fabrication Co., Verona, Pennsylvania.

HAROLD WHITEHEAD, who has been one of the executives of the Business Training Corporation, New York, is sailing next month to London to establish a similar business service of his own. By means of a reciprocal arrangement with his former firm, both concerns will be able to render sales and merchandising service to firms in the export and import field.

G. W. WILLIAMS, president of the Marmon Motor Car Co., Indianapolis, was the principal speaker recently at a conference of public officials and business men of the city for the purpose of giving an opportunity for volunteer city-wide action on the part of all business interests to stimulate employment.

WILLIAM ROBERT WILSON has been appointed general manager of the Reo Motor Co., Lansing, Michigan.

PAUL WISCHNOF has been appointed general superintendent of the Big Rapids plant of the Covel-Hanchett Co., Detroit. Mr. Wischnof was formerly superintendent of the Stearns Motor Co. at Ludington and served his apprenticeship with the Giddings and Lewis Company.

THE WEEKLY PRICE GUIDE . . .

Rise and Fall of the Market

RAILWAY material is no longer in the lead so far as steel buying is concerned. Steel plates, reinforcing bars and pipe now lead in demand. Non-ferrous metals remained notably steady during the last week, with the exception of zinc sheets, which fluctuated very slightly. Linseed oil, the paint barometer, is up 0.2c. per lb., to 15c., f.o.b. New York, in less than 5-bbl. lots. Lack of change (due to slack demand) in scrap prices, presents a sharp contrast with other times, in which quotations fluctuated daily.

(All prices as of Feb. 28, 1930)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$17.69@$18.19
Northern Basic	19.90
Southern Ohio No. 2	19.90
NEW YORK—Tidewater Delivery	
No. 2 Southern (silicon 1.75@2.25)	19.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	15.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76@22.25
Virginia No. 2	24.04
Basic	19.75@20.25
CHICAGO	
No. 2 Foundry, local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	20.01
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	20 26
Basic	20 26
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed*	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10	3.35	3.30	3.90†
No. 12	2.15	3.45	3.35	3.95†
No. 14	2.25	3.55	3.45	4.00†
No. 16	2.35	3.65	3.55	4.10†
Black				
Nos. 18 to 20	2.35@2.55	3.85	3.55	3.70
No. 22	2.50@2.70	4.00	3.70	3.85
No. 24	2.55@2.75	4.05	3.75	3.90
No. 26	2.65@2.85	4.15	3.85	4.00
No. 28	2.80@3.00	4.75	4.00	4.15
Galvanized				
No. 10	2.60	3.90	3.80	3.80
Nos. 12 to 14	2.70	4.00	3.90	3.90
No. 16	2.80	4.10	4.00	4.00
No. 18	2.95	4.25	4.15	4.15
No. 20	3.10	4.40	4.30	4.30
No. 22	3.15	4.45	4.35	4.35*
No. 24	3.30	4.60	4.50	4.50
No. 26	3.55	4.85	4.75	4.75
No. 28	3.80	5.10	5.00	5.00

*Light plates. †Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt	53.74%	41.2%	55.5%	43.5%	55.5%	42.5%
3½ to 6 in. lap	50.32%	37.78%	53.5%	40.5%	51.6%	39.0%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches External	Diameter in Inches Internal	Thickness Inches
⅛	$0.17	1.315	1.049	.133
¼	.23	1.66	1.38	.14
⅜	.27½	1.9	1.61	.145
½	.37	2.375	2.067	.154
⅝	.58½	2.875	2.469	.203
¾	.76½	3.5	3.068	.216
⅞	.92	4.0	3.548	.226
1	1.09	4.5	4.026	.237
1¼	1.48	5.563	5.047	.258
1½	1.92	6.625	6.065	.28
2	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Thickness Decimal Fractions	B.w.g. and	Outside Diameter in Inches ½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.40	3.65	3.60
Cold drawn, flat or square‡	3.90	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick by ¾-in. wide, released for shipment at one time. †Up to 3,999 lb., ordered and ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse— $\frac{3}{32}$, 8.35c. per lb.; ⅛, 7.85c. per lb.; $\frac{5}{32}$ to ½, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			40.25@41.25
Lead, pigs, E. St. Louis	6.10	New York	7.00@ 7.50
Zinc, slabs, E. St. Louis	5.15	New York	6.50@ 7.50

	New York	Cleveland	Chicago
Antimony, slabs	10.50@11.00	11.50	14.50
Copper sheets, base	27.75	27.75	27.75
Copper wire, base	20.12½	20.12½	20.12½
Copper, drawn, round, base	26.25	26.25	26.25
Copper tubing, base	29.25	29.25	29.25
Brass sheets, high, base	23.25	23.25	23.25
Brass tubing, high, base	28.25	28.25	28.25
Brass rods, high, base	21.25	21.25	21.25
Brass wire, high, base	23.75	23.75	23.75

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25@26	24.30	24.30
Zinc sheets (casks).....	10.75@11.25	12.25	10.11
Solder (½ and ½).....	29.25	29.75	28@30
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			57.00
Commercial genuine, intermediate grade.....			42.00
Anti-friction metal, general service.....			31.00
No. 4 babbitt, f.o.b.....			11.50

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold drawn.....	53.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper.....	14.50 @15.00	13.50	13.00 @13.50
Copper, heavy, and wire..	13.50 @14.00	13.00	12.25 @12.75
Copper, light, and bottoms	12.00 @12.25	12.00	11.25 @11.75
Heavy lead.....	4.50 @ 5.00	5.25	4.25 @ 4.75
Tea lead.....	2.87½@ 3.12½	3.25	3.25 @ 3.75
Brass, heavy, yellow.....	7.75 @ 8.00	8.00	7.25 @ 7.75
Brass, heavy, red.....	11.25 @11.75	12.50	10.25 @10.75
Brass, light.....	6.25 @ 6.75	7.00	6.25 @ 6.75
No. 1 rod-brass turnings.	9.00 @ 9.25	8.00	7.75 @ 8.25
Zinc.....	2.50 @ 2.75	3.00	2.00 @ 2.50

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb..	$0.13*	$0.16	$0.15
Cotton waste, colored, per lb..	.09½*	.12	.12
Wiping cloths, washed, white, per lb.....	.12½	38.00 per M	.16
Sal soda, per lb.....	.02½	.02	.02
Roll sulphur, per lb.....	.028	.03½	04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.15	.164	154
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.65	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.24
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt..	30%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*Grade F.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0325
Cold drawn shafting...	per lb..	.034	.035	.035
Brass rods:.....	per lb..	.2125	.2125	.205
Solder (½ and ½).....	per lb..	.2925	.29	.3475
Cotton waste, white...	per lb..	.13	.13	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	4.59	4.59	3.59
Lard cutting oil.....	per gal.	.65	.65	.55
Machine oil.....	per gal.	.33	.33	.30
Belting, leather, medium.....	off list..	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50–10%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*.....	$6.03	$6.03	$6.03
Emery cloth*.....	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†.....	2.61	2.61	2.61
Cloth†.....	4.59	4.59	4.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton.....	Connellsville,		2.60
Coke, prompt foundry, per net ton.....	Connellsville,		3.50@4.85
White lead, dry.....	100 lb. kegs ...	New York,	13.75
White lead, in oil.....	100 lb. kegs....	New York,	14.25
Red lead, dry.....	100 lb. kegs....	New York,	13.75
Red lead, in oil.....	100 lb. kegs....	New York,	15.25

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, $\frac{7}{16}$-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$8.50
Cast iron welding flux, per lb., net.....	.35
Brazing flux, per lb., net.....	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

Ala., Gadsden—Gulf States Steel Co., W. H. Coverdale, Pres., Brown-Marx Bldg., Birmingham, purchasing machinery and equipment for sheet mill here.

Ind., Anderson—Ames Co., new machinery and equipment for the manufacture of shovels of all kinds for factory recently destroyed by fire. Loss $200,000.

N. H., Nashua—M. Graber, P. O. Box 516, circular saw mill, 16 ft. carriage and 54 in. saw, complete outfit.

Ore., Portland—Francis Motor Car Co., 405 Hawthorne Ave., lathes, drills, car hoists and shaper, etc., for proposed 3 story, 90 x 100 ft. garage and shop at Grand Ave. and East Morrison St. Estimated cost $40,000.

Tex., El Paso—Houston Cooperage & Tube Co., 3100 Canal St., Houston, is receiving bids on general contract, machinery and equipment for 1 and 2 story barrel factory here. Estimated cost $80,000.

Opportunities for Future Business

Conn., East Hampton—N. N. Hill Brass Co., 25 Skinner St., awarded contract for a 2 story, 40 x 100 ft. factory. Estimated cost $40,000.

Conn., Manchester—O'Meara Motor Sales Co., 285 Connecticut Blvd., Hartford, awarded contract for the construction of a 1 story, 75 x 125 ft. service building on Maple St. here. Estimated cost $40,000. Noted Feb. 13.

Conn., Waterbury—Bristol Co., G. Lewis, is having preliminary plans prepared for the construction of a factory at Platts Mills. Estimated cost $50,000. F. A. Webster, 51 West Main St., Archt.

Ill., Chicago—Walker Vehicle Co., 8700 South State St., awarded masonry contract for a 1 story, 300 x 390 ft. addition to factory at West 87th and State Sts. Estimated cost $250,000.

Kan., Coffeyville—Ozark Smelting & Mining Co., awarded contract for addition to plant. Estimated cost $300,000.

Mass., Attleboro—G. A. Sweeney, 160 Main St., is receiving bids for the construction of a 1 story garage, service station and repair shop on County St. Estimated cost $40,000. Private plans. Noted Feb. 20.

Mass., Belmont—John O'Connor, 14 North Munroe Terrace, Dorchester, awarded contract for a 1 story, 80 x 120 ft. garage and repair shop on Trapelo Rd. here. Estimated cost $40,000. Noted Dec. 19.

Mass., Boston—Boston Elevated Railway Co., Park Sq. Bldg., will build a 3 story addition to machine shop at 439 Albany St. Estimated cost $40,000. Private plans. Work will be done by day labor.

Mass., Cambridge—General Radio Co., M. Eastham, 30 State St., is having plans prepared for the construction of a 4 story factory. Estimated cost $80,000. Lockwood Greene Engrs. Inc., 24 Federal St., Boston, Engrs.

Mass., East Boston (Boston P. O.)—Atlantic Works, 80 Border St., plans reconstruction of forge and blacksmith shop destroyed by fire on Border St. Architect not selected.

Mass., Fitchburg—Firestone Tire Stores, Inc., 141 Brookline Ave., Boston, awarded contract for a 1 story, 60 x 100 ft. service station and repair shop on Main and Academy Sts. Estimated cost $40,000.

Mass., Lowell—J. Blackstock, 31 Morton St., had plans prepared for the construction of a 1 story garage and repair shop at 576 Rogers St. Estimated cost $40,000. Private plans.

Mass., Medford (br. Boston) — Somerville Iron Foundry Co., 85 Washington St., Somerville, is having preliminary plans prepared for a 1 story, 55 x 150 ft. foundry. Estimated cost $50,000 to $60,000. Private plans.

Mass., Newton (Br. Boston)—N. T. Turner, 320 Washington St., had plans prepared for a 2 story addition to repair and service garage Estimated cost $40,000. Private plans.

Mass., Springfield—Granville Bros. Aircraft Corp., Z. H. Granville, Pres., 1211 Liberty St., plans the construction of a factory at Fisk airport. Estimated cost to exceed $40,000. Architect not selected.

Mass., Worcester—City, R. I. Rose, Supt. of Streets, plans the construction of a garage and repair shop on Salem St. Estimated cost $50,000. Architect not selected.

Mich., Lapeer—Michigan State Administrative Board, W. J. Kay, Supt., Lansing, will receive bids until Mar. 12 for the construction of a 2 and 3 story home and training school here. Estimated cost $1,000,000. Maul & Lentz, 1259 David Whitney Bldg., Detroit, Archts.

Mo., Kansas City—National Garage Co., c/o H. A. Lubbin, 1220 Finance Bldg., will soon award contract for the construction of a 6 story, 115 x 156 ft. garage at 11th and McGee Sts. G. E. McIntyre, 800 Finance Bldg., Archt. and Engr.

N. J., Elizabeth—J. Skramouvsky, 51 Dayton St., is having preliminary plans prepared for the construction of a 1 story work shop at 10-12 South Spring St. Estimated cost $40,000. J. B. Beatty, 15 North Reid St., Archt.

N. J., Newark—General Alloy Co., 188 New Jersey Railroad Ave., is having plans prepared for the construction of a 2 story factory on Maple Pl. Estimated cost $40,000. P. B. West, 24 Commerce St., Archt. Noted Feb. 27.

N. J., Newark—National Washer Co., Pennington St., will soon award contract for the construction of a 4 story factory. Estimated cost $50,000. Monks & Johnson, 99 Chauncy St., Boston, Mass., Archts. Noted Feb. 20.

N. J., Newark—Newark Special Tool & Machine Co., 51 Lawrence St., is having preliminary plans for the construction of a 1 story, 90 x 110 ft. factory at 87-95 St. Francis St. Estimated cost $40,000. M. B. Silberstein, 964 Broad St., Archt.

N. J., Newark—Public Service Co., 80 Park Pl., awarded contract for the construction of a 1 story, 100 x 160 ft. garage on Doremus Ave. Estimated cost $150,000.

N. J., North Bergen—Theurer Wagon Works, Inc., 601 West 56th St., New York, N. Y., awarded contract for a 3 story addition to factory at 3937 Hudson Blvd. Estimated cost $40,000. G. Willaredt, 411 23rd St., West New York, N. J., Archt. Noted Feb. 27.

N. J., West New York—C. H. A. Muller, 322 15th St., Archt., will receive bids about Mar. 15 for a 2 story, 100 x 125 ft. garage, etc. at 16th St., between Buchanan Pl. and Broadway, for O. L. Auf Der Heide, 443 16th St. Estimated cost $150,000. North Jersey Auto Sales Co., 729 Bergenline Ave., lessee.

N. Y., Brooklyn—Albermarle Heights Building Corp., 32 Court St., will receive bids about June 1 for the construction of a 1 story, 125 x 231 ft. garage at Gravesend and Ditmars Aves. Estimated cost $50,000. W. F. Doyle, 11 John St., New York, Archt. Noted Feb. 27.

N. Y., Brooklyn—L. Berger & Co., plans addition to garage at Gates Ave. and Seneca St. Estimated cost $40,000. G. Beinbrink, 1815 Gates Ave., Archt.

N. Y., Brooklyn—A. A. Blaustein, 1102 King Highway, Archt., is receiving bids for the construction of a shop building at Ashland Pl. and DeKalb Ave. for C. Bender, 94 Prospect Park. S. and J. F. McGovern, 299 Prospect Park W. Estimated cost $40,000.

N. Y., Brooklyn—Cameo Holding Corp., 50 Court St., will receive bids about June 1 for the construction of an 83 x 100 ft. garage and service station at Warwick St. and New Lots Ave. Estimated cost $65,000. J. J. Millman, 26 Court St., Archt. Noted Feb. 27.

N. Y., Brooklyn—J. M. Halleren, 2191 Nostrand Ave., will soon receive bids for the construction of a 100 x 168 ft. garage at Nostrand Ave. and Ave. H. Estimated cost $75,000. Seelig & Finkelstein, 153 Peirrepont St., Archts. Noted Feb. 27.

N. Y., Brooklyn—Hegeman Farms Corp., 325 Center St., plans the construction of a 2 story, 75 x 100 ft. garage at Center St. and Wycoff Ave. Estimated cost $40,000. E. Guteman, c/o owner, Archt.

N. Y., Long Island City—A. Brisbane, c/o Merole Bros., 2376 First Ave., New York, will receive bids after May 15 for the construction of a garage at 43rd Ave. and Rawson St. Estimated cost $50,000. A. Kunzi, 781 Manhattan Ave., Brooklyn, Archt. Noted Feb. 20.

N. Y., Long Island City—H. Haber, c/o C. H. Kahrs, 110 East 42nd St., New York, plans the construction of a 2 story, 81 x 127 ft. garage at Newton Ave. and 31st St. Estimated cost $50,000.

N. Y., New York—Bell Laboratories, Inc., 195 Broadway, plans addition to plant and laboratory at 455 West St. Estimated cost $100,000. Voorhees, Gmelin & Walker, 101 Park Ave., Archts.

N. Y., New York—Forty-Four West 66th St., Corp., c/o Bloch & Hess, 18 East 41st St., Archts., is receiving bids for the construction of a 2 story garage at 44 West 66th St. Estimated cost $150,000. Noted Feb. 20.

N. Y., New York—A. T. Mannon, c/o G. J. O'Reilly, 11 East 44th St., awarded contract for the construction of a garage at 318 East 48th St. Estimated cost to exceed $150,000. Noted Feb. 27.

O., Cincinnati—Aluminum Industries, Inc., Beekman St., awarded contract for the construction of two 1 story factory buildings on Beekman St. Estimated total cost $100,000.

O., Cleveland—Cleveland Railway Co., C. Stanley, Purch. Agt., Hanna Bldg., is having plans prepared for the construction of a service and repair shop at Demson Ave. and West 73rd St. Estimated cost $40,000. Wilbur Watson & Associates, 4614 Prospect Ave., Archts.

O., Cleveland—General Electric Co., W. E. Streator, Const. Engr., Nela Park, awarded contract for a 1 story, 110 x 177 ft. addition to garage. Estimated cost $150,000.

O., Cleveland—Osborn Mfg. Co., E. H. W. Hopp, Const. Mgr., 5401 Hamilton Ave., brush manufacturers, had plans prepared for the construction of a 1 story machine shop. Estimated cost $50,000. The Austin Co., 16112 Euclid Ave., Archt.

O., Cleveland—J. O. Taylor, c/o owner, Fisher Bldg., Chicago, Ill., Engr., is receiving bids for the construction of a 3 story, 79 x 200 ft. addition to factory at East 116th and Harvard Ave., for The Kroehler Mfg. Co., 3134 Prospect Ave. Estimated cost $200,000. Noted Feb. 27.

O., Cleveland—Western Reserve University, S. S. Wilson, Secy. and Treas., 10940 Euclid Ave., awarded contract for a 5 story, 120 x 128 ft. service building on Adelbert Rd. Estimated cost $250,000.

O., Kenmore (br. Akron)—Palmer Match Co., plans the construction of a 1 story, 60 x 150 ft. factory on Corey Ave. Estimated cost $50,000. Private plans.

Okla., Oklahoma City—Oklahoma Operating Co., 304 West First St., awarded contract for a 1 story, 200 x 130 x 140 ft. garage and repair shop on Noble St. Estimated cost $175,000.

Pa., Lansdale—Franklin Pottery Co., plans addition to machine shop. Estimated cost $40,000.

Pa., New Castle—Pennsylvania Power Co., M. Moses, Local Rep., Sharon, will build a 2 story service building including work shop, garage, etc. Estimated cost $100,000. Stevens & Wood, 60 John St., New York, N. Y., Engrs. Work will be done by separate contracts. Noted Feb. 27.

Pa., Philadelphia—Gulf Refining Co., C. T. Merch, Frick Bldg. Annex, Pittsburgh, will receive bids until Mar. 8 for the construction of a 1 story, 20 x 65 ft. machine shop at Girard Point, here. Private plans.

Pa., Philadelphia—Morris Wheeler & Co., Inc., 30th and Locust Sts., (iron workers) awarded contract for the construction of a 1 story, 353 x 423 ft. warehouse at Fox and Roberts Sts.

Tenn., Chattanooga—Tennessee Stove Works, Greenwood Ave., awarded contract for the construction of an enameling plant. Estimated cost $30,000.

Tenn., Memphis—Memphis Power & Light Co., 179 Madison Ave., awarded contract for 2 story addition to garage on Walnut St. Estimated cost $30,000.

Tenn., Memphis—Southern States Iron Roofing Co., J. Fulenwilder & Associates, 1000 Peabody St., is having tentative plans being made for rebuilding metal plant destroyed by fire at 46 West Virginia St. Loss $150,000.

Wash., Seattle—Bureau of Yards & Docks, Washington, D. C., will receive bids until Mar. 12 (extended date) for the construction of a 1 story shop building and storehouse, here. Noted Feb. 6.

W. Va., Wierton—Wierton Steel Co., awarded contract for the construction of a rail and structural mill. Estimated cost $3,500,000.

Ont., Peterboro—D. W. Magee, Park St., Engr., will receive bids until Mar. 8 for the construction of a 1 story, 160 x 400 ft. plant for the manufacture of switchboards for Canadian General Electric Co., Park St. Estimated cost $200,000.